Soil Survey of

Potter County, Texas

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Texas Agricultural Experiment Station

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

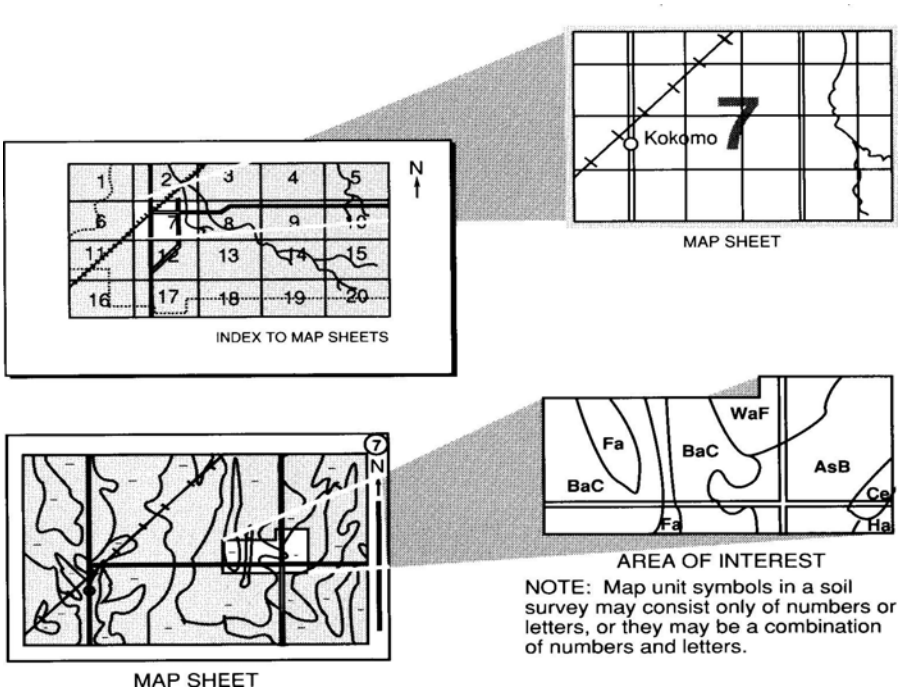
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Click the mouse on the number of the map sheet, the link will take you to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Go to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1967-74. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Canadian River Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Native plant cover of sideoats grama, blue grama, little bluestem, and scattered yucca on Mixedland Slopes range site. The soil is Mobeetie fine sandy loam, 3 to 5 percent slopes.

Contents

Issued February 1980

Index to map units

Summary of tables

Summary of tables—Continued

Foreword

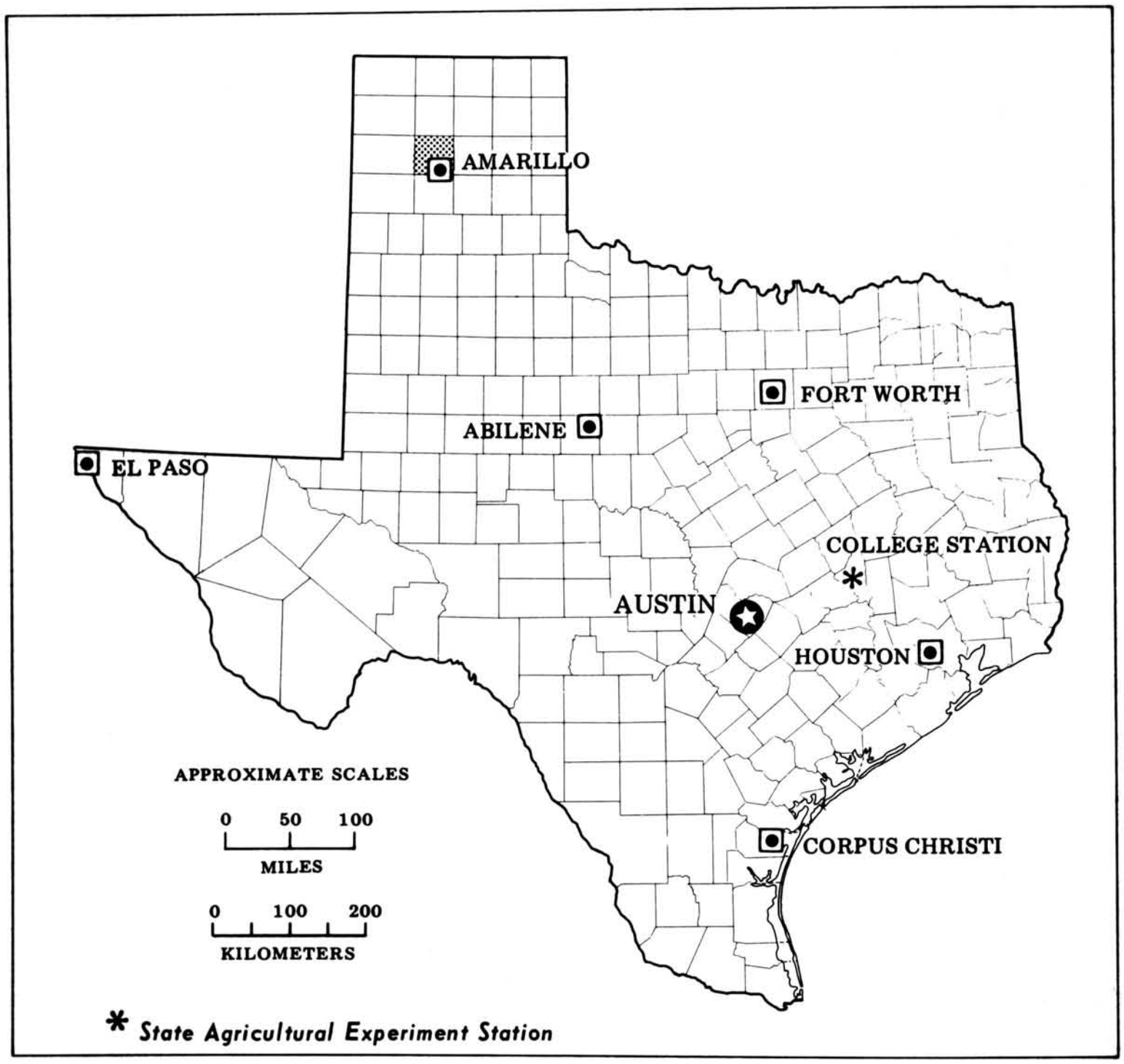
This soil survey contains information that can be used in land-planning programs in Potter County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Potter County in Texas.

SOIL SURVEY OF POTTER COUNTY, TEXAS

By Fred B. Pringle, Soil Conservation Service

Fieldwork by Luther C. Geiger, Herbert E. Bruns, and Fred B. Pringle

United States Department of Agriculture, Soil Conservation Service
in cooperation with Texas Agricultural Experiment Station

POTTER COUNTY is in the central part of the Texas Panhandle. It is about 30 miles square. It has a total area of 587,520 acres, or 918 square miles. The elevation ranges from about 3,000 feet at Lake Meredith to 3,800 feet at Bushland. In 1970, the population was 90,511. It is rapidly increasing.

Amarillo is the county seat. It is a major transportation hub and a center for agribusiness, banking, petrochemicals, natural gas, and other industries. It is the world center for processing and storing helium, a byproduct of natural gas.

The county is about 75 percent rangeland, 10 percent cropland, 8 percent urban land, and 7 percent federal land and water areas (*5*). Beef cattle is the main enterprise. Grain sorghum, winter wheat, and corn are the principal crops. About one-third of the cropland is irrigated from deep wells.

General nature of the survey area

Potter County was organized in 1887. Amarillo, the county seat, was founded on August 6, 1887. Following 1888 and into the early 1890's, Amarillo became the world's greatest cattle shipping market.

On the pages that follow is general information on the physiography, relief, and drainage of the county and the agriculture, natural resources, transportation, and climate.

Physiography, relief, and drainage

Potter County is in the southern part of the Great Plains, which extends from Texas into Canada. Most of the county lies in the valley of the Canadian River (fig. 1). The river and its valley are the dominant topographic features in the northern part of the county. The Canadian Breaks along the river is an undulating to steep area of hills, slopes, and canyons, in sharp contrast with the flat prairies of the High Plains. The Canadian Breaks make up about 85 percent of the county and the nearly level tableland in the southern part of the county, the High Plains, 15 percent.

The Canadian Breaks, mostly in the Rolling Plains Land Resource Area, has characteristic rolling relief, a well developed drainage system, and several landforms, the most prominent of which is the escarpment along the edge of the High Plains. A few scattered mesas and hills are interspersed with flats and valley fills. Along and on either side of the Canadian River are several windblown sandy areas— hummocks and dunes.

The soils of the Rolling Plains, formed under grass vegetation, are mainly light colored, loamy, and clayey.

The High Plains is a nearly level treeless plain that formed in Rocky Mountain outwash (*4*) and an overlying eolian mantle (*3*). Except where pitted by playas, the surface is remarkably smooth. The average grade of the High Plains is about 10 feet per mile to the southeast. Runoff follows a poorly defined pattern, flowing into the playas from the surrounding nearly level areas. These playas are dish shaped and range from less than 5 to several hundred acres.

The soils on the High Plains, formed under a dense cover of short grasses, are dominantly dark colored and loamy.

Management problems of the soils in Potter County are generally related to the texture and the slope. Unprotected areas are subject to soil blowing and water erosion. Periods of drought are characteristic of the southern Great Plains.

Agriculture

Agriculture, mainly cattle ranching, irrigated farming, and dryland farming, is the chief enterprise in Potter County. Cattle ranching was the first agricultural occupation. Farming began when settlers came from the Midwest and planted small grain.

Cropland and rangeland generally conform to the smooth High Plains and the rolling topography of the

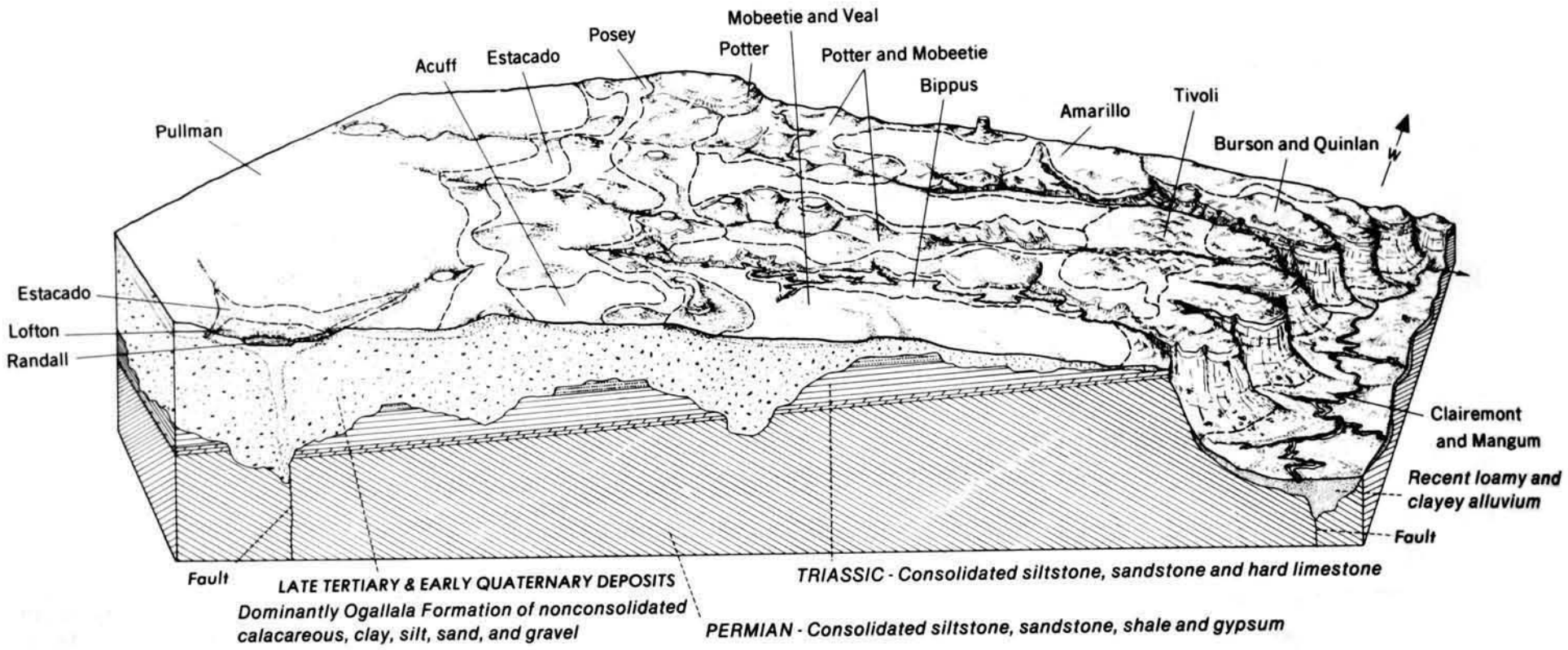


Figure 1.—Pattern of soils in Potter County.

Canadian Breaks. Practically all the cropland is on the High Plains.

Winter wheat, grain sorghum, and corn are the most important crops. Wheat and grain sorghum are dry-farmed and irrigated. Corn is grown only under irrigation. Wheat is grown mainly for grain, but much of the acreage in wheat is also used for winter pasture.

Irrigation was introduced in the early 1950's.

Livestock operations are mainly cow-calf. Supplemental feeding is generally heavy from December through March.

Natural resources

Natural gas and oil are produced from numerous wells in the county. A number of industries that produce petrochemicals and helium followed development of the natural gas fields. Helium, a byproduct of natural gas, is refined, stored, and shipped from nine plants around Amarillo.

Numerous wells supply water for approximately 18,000 acres of irrigated farmland in the county. The source of the underground water used for nearly all irrigation is the saturated sand and gravel at the base of the Ogallala Formation.

The sand and gravel mined commercially from the Ogallala Formation is used mainly in construction. Caliche is plentiful in the county and is mined for use in local road construction and in the manufacture of Portland cement.

Transportation

As a result of transportation, Amarillo is a distribution and wholesale center. U.S. Highways 60, 87, and 287 and Interstate Highway 40 serve the city. Five airlines offer air transportation to all parts of the globe. Three railroads provide service to Amarillo. The headquarters of one is based in this city.

Climate

Potter County has a dry steppe climate marked by mild winters. The average annual precipitation is 20.28 inches. Approximately 79 percent of this amount falls in May through October. Rain occurs most frequently as thundershowers. Monthly and annual amounts are extremely variable. Annual extremes since 1949 range from 36.67 inches in 1960 to only 9.56 in 1970. Table 1 gives the temperature, precipitation, and wind data for the county. The prevailing winds are southwesterly from October through April and southerly from May through September. Windspeed averages about 13.7 miles per hour. The average annual relative humidity is estimated to be 72 percent at 6:00 a.m., 44 percent at noon, and 40 percent at 6:00 p.m. The Amarillo area receives approximately 73 percent of the total possible sunshine annually. Seasonal variations in both relative humidity and sunshine are small. The average annual lake evaporation is estimated to be 68 inches.

In winter, frequent surges of polar and arctic air masses bring strong northerly winds and rapid drops in temperature. Cold spells, however, are short, rarely lasting longer than 48 hours before sunshine and southwesterly winds bring rapid warming. Freezes occur almost

every night. Days are usually sunny, and the daily high temperature averages 51.3 degrees F. The lowest temperature ever recorded at Amarillo, -16 degrees, occurred on February 12, 1899. Winter is a dry season. Precipitation most often falls as light snow.

Spring is a season of frequent weather changes. Warm and cold spells follow each other in rapid succession throughout March and April. These are the windiest months of the year. At times, strong, persistent southwesterly to northwesterly winds produce duststorms. Thunderstorms, which rarely occur in winter, increase in number through spring and reach a peak in May and June.

In summer, afternoon temperatures are sometimes hot, but most nights are pleasantly cool. The daily low temperature in summer averages 63.9 degrees. The highest temperature on record at Amarillo, 108 degrees, occurred on June 24, 1953. Evaporative-type air conditioners operate efficiently in this relatively dry climate. Forty-six percent of the average annual precipitation falls in May through July. June is usually the wettest month. A few thunderstorms late in spring and early in summer are at times accompanied by damaging wind and hail. Thunderstorm activity gradually decreases in July and August. Thunderstorms occur on an average of 48 days annually at Amarillo.

In fall, cold fronts push southward through the area. Rainfall decreases progressively from September through November. Mild sunny days and crisp cool nights are characteristic.

The growing season, or freeze-free period, at Amarillo averages 198 days. The average dates of the last occurrence of 32 degrees in spring and the first in fall are April 20 and October 28, respectively.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 2 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *irrigated cropland, nonirrigated cropland, irrigated specialty crops, rangeland,*

urban uses, and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Urban uses include residential, commercial, and industrial developments. Recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic.

The eight map units on the general soil map make up about 98 percent of the county. Bodies of water covering more than 40 acres make up about 2 percent. The largest of these bodies are Lake Meredith and the Canadian River.

Descriptions of map units

1. Acuff-Paloduro-Olton

Nearly level to sloping, deep, noncalcareous and calcareous loamy soils

The map unit consists of Acuff and Olton soils on nearly level to gently sloping plains and Paloduro soils on gently sloping to sloping side slopes along the many drainageways and creeks that dissect the area.

This unit makes up about 32 percent of the county. Acuff soils make up about 29 percent of the unit, Paloduro soils 15 percent, Olton soils 12 percent, and Bippus, Estacado, Mobeetie, and Posey soils, 44 percent.

Acuff soils have a dark brown, neutral loam surface layer about 11 inches thick. From 11 to 52 inches is brown, moderately alkaline clay loam. From 52 to 65 inches is pink, calcareous clay loam that is about 40 percent calcium carbonate.

The surface layer of Paloduro soils is dark brown, calcareous clay loam about 12 inches thick. From 12 to 80 inches is brown, calcareous clay loam that contains a few threads and films of calcium carbonate.

The surface layer of Olton soils is dark brown, mildly alkaline clay loam 10 inches thick. From 10 to 55 inches is reddish brown, moderately alkaline clay loam. From 55 to 74 inches is yellowish red, calcareous clay loam that is about 30 percent calcium carbonate. From 74 to 80 inches is reddish yellow, calcareous clay loam.

Most of this unit is used as rangeland. The potential is medium.

Some small tracts are used for cultivated crops. The low, variable annual rainfall and an inadequate supply of high quality irrigation water are the main limitations in farming.

The potential for use as cropland is high. To achieve this potential, careful management is needed to control water erosion and soil blowing and to conserve soil moisture.

Part of the city of Amarillo is within this map unit. The landscape is scenic. Slope and low strength are the main limitations in urban use. Nearly all plants used in gardening and landscaping can be grown successfully on these soils. The potential for urban use of these soils is high.

Wildlife, particularly pronghorn, is abundant throughout the unit. The potential is medium for wildlife habitat.

The potential is medium for recreation areas. Slow permeability and slope are limitations.

2. Pullman

Nearly level to gently sloping, deep, noncalcareous loamy soils

This map unit consists of Pullman soils on the nearly level to gently sloping broad expanses of treeless plains that are interrupted only by the numerous playa basins. Soils of the playas occur as shown in figure 2. The somewhat poorly drained Randall soils on the playa bottom are periodically inundated by runoff. Lipan and Lofton soils are on benches, and Estacado soils are on side slopes.

This map unit makes up about 16 percent of the county. Pullman soils make up 71 percent of the unit, and Estacado, Lipan, Lofton, and Randall soils 29 percent.

Pullman soils have a brown, neutral clay loam surface layer about 7 inches thick. From 7 to 33 inches is dark brown, moderately alkaline clay. From 33 to 54 inches is reddish brown to yellowish red, calcareous clay. From 54 to 80 inches is pink, calcareous clay loam that is about 30 to 50 percent calcium carbonate.

This map unit is extensively cultivated. It includes most of the cropland in the county. The potential is high for irrigated and nonirrigated crops and specialty crops. Because of the smooth, nearly level topography, Pullman soils are well suited to surface irrigation. Little or no land leveling is needed. Conserving soil moisture, controlling water erosion, and reducing soil blowing are the main management needs.

This treeless, short grass prairie has medium potential for use as rangeland.

Part of the city of Amarillo is within this map unit. The low strength, high shrink-swell potential, and high risk of corrosion on uncoated steel pipe are limitations that are sometimes difficult and costly to overcome. For this reason, the potential for urban use is low.

The potential is medium for wildlife. Crop stubble provides cover for pheasant, dove, and quail. Wildlife feeds on wasted grain in fall and winter. The intermittent lakes in the playa basins provide habitat for waterfowl.

The potential is medium for recreation areas. The main limitations are the clayey texture and the very slow permeability.

3. Mobeetie-Tascosa

Gently sloping to hilly, deep, calcareous loamy and gravelly soils

This map unit, in the sloping to hilly part of the county, has well defined drains. Tascosa soils are on ridgetops and crests of hills, and Mobeetie soils occupy the side slopes and foot slopes. Other soils are Bippus, Clairemont, Likes, Quinlan, Veal, and Weymouth.

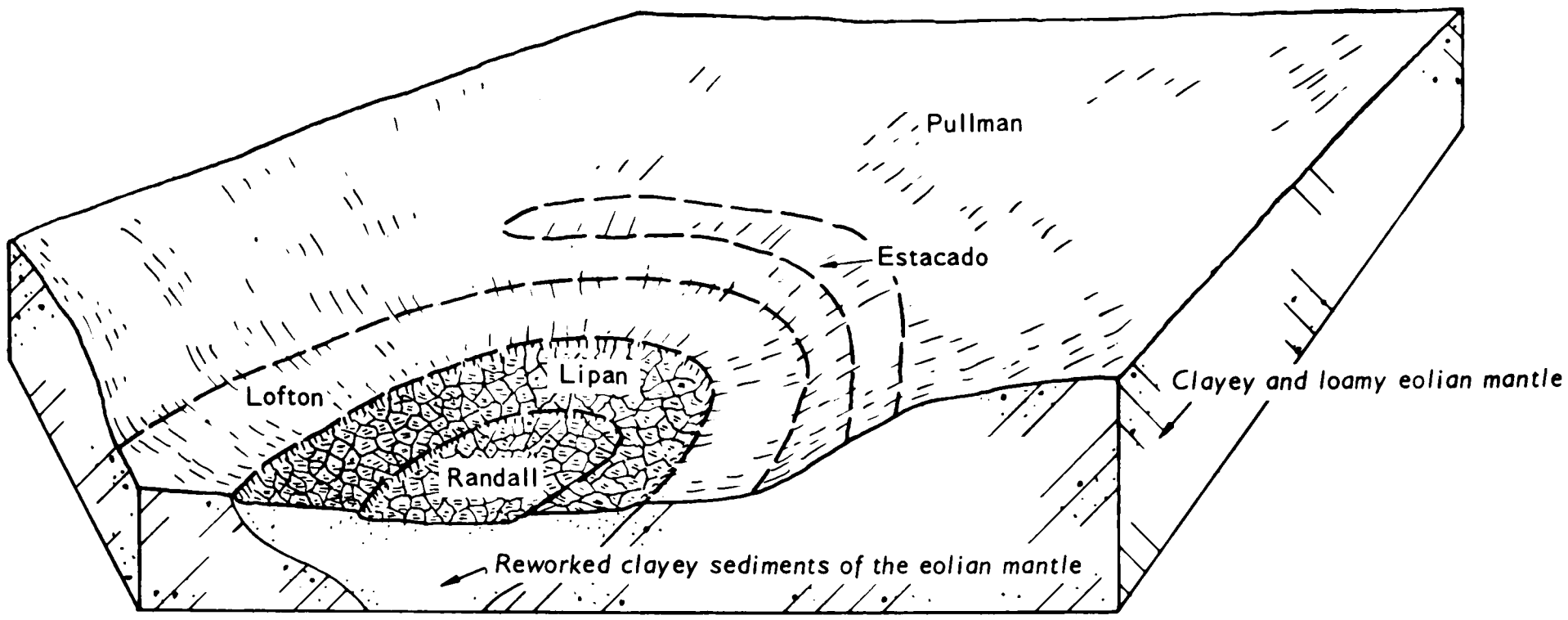


Figure 2.—Pattern of soils in Pullman map unit.

This unit makes up approximately 13 percent of the county. Mobeetie and Tascosa soils each make up about 35 percent of the unit and minor soils, water areas, and gravel pits 30 percent.

Mobeetie soils have a grayish brown, calcareous fine sandy loam surface layer about 9 inches thick. From 9 to 42 inches is brown, calcareous fine sandy loam. From 42 to 60 inches is light brown, calcareous fine sandy loam.

Tascosa soils have a dark grayish brown, calcareous gravelly loam surface layer about 10 inches thick. From 10 to 18 inches is grayish brown, calcareous very gravelly loam. Below this is very pale brown, calcareous very gravelly sandy loam to very gravelly loam.

This map unit is entirely rangeland. The potential is medium. Slope and gravel or small stones make farming or urban use impractical. Some areas of Tascosa soils are a source of sand and gravel, which is mined commercially for use in the construction industry.

Deer and pronghorn inhabit these areas. The potential is high for wildlife habitat.

The potential is low for recreation areas because of the slope and in some places the small stones.

4. Veal-Mobeetie

Gently sloping to rolling, deep, calcareous loamy soils

The landscape in this unit is one of gently sloping to rolling hills and ridges that are separated by small drainageways. Veal soils are on convex ridgetops and hills. Mobeetie soils are on side slopes and foot slopes.

This map unit makes up about 12 percent of the county. Veal soils make up about 42 percent of the area, Mobeetie soils 20 percent, and Paloduro, Acuff, Bippus, Clairemont, Likes, Posey, and Tascosa soils 38 percent.

Veal soils have a brown, calcareous loam surface layer about 6 inches thick. From 6 to 14 inches is a light brown, calcareous clay loam. From 14 to 60 inches is pinkish gray to pink, calcareous clay loam that is about 35 to 50 percent calcium carbonate.

The surface layer of Mobeetie soils is grayish brown, calcareous fine sandy loam about 9 inches thick. From 9 to 42 inches is brown, calcareous fine sandy loam. From 42 to 60 inches is light brown, calcareous fine sandy loam.

This map unit is used mainly as rangeland. The potential is medium. Slope and the high lime content of Veal soils are limitations that make farming impractical. Most of this unit is not suited to crops.

The potential is high for most urban uses. Slope is the main limitation. With careful management, most plants used in gardening and landscaping can be grown successfully on these soils.

The potential is medium for wildlife habitat. Deer and pronghorn are common.

The potential is medium for recreation areas. Slope is the main limitation.

5. Weymouth-Vernon

Undulating to rolling, moderately deep, calcareous loamy and clayey soils

The unit consists of Weymouth soils on smooth, gently sloping plains, and Vernon soils on gently sloping to sloping side slopes along draws. These areas are dissected by many small drainageways. Geologic erosion is active in some places.

This map unit makes up about 11 percent of the county. About 29 percent of the unit is Weymouth soils, 20 percent Vernon soils, and 51 percent Burson, Clairemont, Owens, and Quinlan soils and rock outcrop and areas of barren shaly and clayey red beds.

The surface layer of Weymouth soils is reddish brown, calcareous clay loam about 9 inches thick. From 9 to 38 inches is reddish brown to yellowish red, calcareous clay loam that is up to 15 percent films and soft masses of calcium carbonate. From 38 to 80 inches is yellowish red, partially weathered shale of silty clay loam texture.

Vernon soils have a reddish brown, calcareous clay surface layer about 7 inches thick. From 7 to 38 inches is reddish brown, calcareous clay that contains a few concretions of calcium carbonate. Below this is red, calcareous marine clayey shale.

This map unit is used mainly as rangeland. Because of slope and the hazard of erosion, the droughty soils have very low potential for use as farmland.

These soils have a low potential for most urban uses. The slope, high shrink-swell potential, low strength, and the high risk of corrosion to uncoated steel pipe are limitations that are difficult and costly to overcome.

Some of the clayey areas of this map unit have been the source of material used in the manufacture of brick.

The potential is medium for openland and wildlife habitat. Pronghorn and deer inhabit these areas.

The potential is low for recreation areas. The clayey surface soil and slope are the main limitations.

6. Likes-Tivoli

Gently undulating to rolling hummocks and dunes of deep, calcareous and noncalcareous sandy soils

The landscape in this unit is one of gently undulating to rolling hummocks and dunes in windblown areas adjacent to the Canadian River.

This map unit makes up about 7 percent of the county. Likes soils make up about 55 percent of the area, Tivoli soils 19 percent, and Amarillo, Lincoln, Springer, and Veal soils 26 percent.

The surface layer of Likes soils is about 14 inches of grayish brown to brown, calcareous loamy fine sand. The underlying material to a depth of 60 inches is calcareous loamy fine sand that is pale brown in the upper part and yellowish brown below.

Tivoli soils have a brown, neutral fine sand surface layer about 5 inches thick. From 5 to 60 inches is light brown, mildly alkaline fine sand.

This map unit is used entirely as rangeland. It includes some of the better grazing land in the county. Under continued heavy use, however, the vegetation deteriorates rapidly to woody plants, weeds, and undesirable grasses. The hazard of soil blowing is severe. The potential is very low for crops.

The potential is high for urban use.

The potential is medium for wildlife habitat. Deer inhabit these areas.

The potential is low for recreation areas because of the sandy soil and the slope.

7. Burson-Quinlan-Aspermont

Undulating to steep, very shallow, shallow, and deep calcareous loamy soils

The landscape in this unit is one of escarpments, bluffs, canyon walls, strongly sloping to steep foot slopes, and severely gullied areas intermingled with very shallow to deep, undulating and sloping soil. Areas along the Canadian River and its tributaries are some of the more scenic places in Potter County. Geologic erosion is active. The plant cover in most places is too sparse to prevent rapid, excessive runoff. Burson soils are on steep side slopes, Quinlan soils are on narrow ridgetops and benches above rock outcrop, and Aspermont soils are on foot slopes.

This map unit makes up about 5 percent of the county. Burson soils and rock outcrop make up about 27 percent of the area, Quinlan soils 16 percent, Aspermont soils 13 percent, and Clairemont, Mangum, and Yomont soils 44 percent.

Burson soils have a red, calcareous loam surface layer about 6 inches thick. From 6 to 60 inches is red, calcareous very fine grained sandstone.

Quinlan soils have a reddish brown, calcareous very fine sandy loam surface layer about 6 inches thick. From 6 to 14 inches is reddish brown, calcareous very fine sandy loam. The underlying material is red, calcareous weakly cemented sandstone.

The surface layer of Aspermont soils is reddish brown, calcareous silty clay loam about 10 inches thick. From 10 to 34 inches is reddish brown, calcareous silty clay loam. From 34 to 80 inches is red, calcareous silty clay loam.

This map unit is used entirely as rangeland and wildlife habitat. The potential is medium for rangeland. The steep, broken topography provides an ideal refuge for many kinds of wildlife. Among these are deer, rabbit, skunk, opossum, and rattlesnakes. Use as rangeland is limited because much of the unit is inaccessible to cattle and horses. The potential is very low for crops.

The depth to bedrock and the slope are severe limitations.

The potential is low for recreation and urban use.

8. Potter-Mobeetie

Sloping to steep, very shallow, shallow, and deep calcareous gravelly and loamy soils

The landscape in this unit is one of caliche escarpments and colluvial foot slopes that border the High Plains. Potter soils are in sloping to steep areas above the nearly vertical escarpments. Mobeetie soils are on the sloping to strongly sloping foot slopes. Many areas of this map unit are rugged and scenic.

This map unit makes up approximately 2 percent of the county. About 30 percent of the area is Potter soils

and caliche outcrops, 16 percent Mobeetie soils, and 54 percent Acuff, Bippus, and Veal soils and caliche pits.

Potter soils have a pinkish gray, calcareous gravelly loam surface layer about 9 inches thick. The underlying material is a pink, platy caliche bed.

Mobeetie soils have a grayish brown, calcareous fine sandy loam surface layer about 9 inches thick. From 9 to 60 inches is brownish, calcareous fine sandy loam.

This map unit is used as rangeland and wildlife habitat. The potential is low for rangeland. Because of the steep terrain, it is difficult for cattle to graze the higher areas, but these areas provide good habitat for deer and other wildlife.

The potential for urban use is very low on Potter soils and high on the less sloping Mobeetie soils. Depth to rock and steep slopes are severe limitations in some places. This unit is a source of caliche, which is mined commercially for use in road building. This material is also used in the manufacture of Portland cement.

The potential is medium for wildlife habitat. Deer and pronghorn inhabit these areas.

The potential is low for recreation areas because of the slope and small stones.

Broad land use considerations

The map units in the county vary widely in their potential for major land use, as indicated in table 2. For each land use, general ratings indicate the potential of each map unit as it relates to other map units. Kinds of soil limitations are also indicated in general terms. Soil potentials reflect the relative cost of such practices and the hazard of soil related problems after such practices are installed. The ratings do not consider the location as related to transportation systems or other kinds of facilities.

Kinds of land use considered are cropland, rangeland, urban land, and recreation. Cultivated crops grown extensively are grain sorghum, wheat, and corn. Specialty crops are vegetable and nursery crops grown on limited acreage, generally those that require intensive management. Rangeland refers to land in native grass. Urban land refers to residential, commercial, and industrial use. Recreation includes camp areas, picnic areas, playgrounds, paths and trails, nature study area trails, wilderness areas, and the like.

Each year about 700 acres of agricultural land is developed for urban use in and around the city of Amarillo. About 20,000 acres is urban or built-up land. Much of this acreage was well suited to use as irrigated cropland. About one-half of this acreage is nearly level to gently sloping soils that are poorly suited to urban development because of the high shrink-swell potential, low strength, and the high risk of corrosion to uncoated steel pipe. Some playas are periodically inundated by runoff. These soils are unsuitable for use as cropland or building sites. Data for specific soils is available in this soil survey for planning future land use.

Most of the map units can be used for urban development. A small part of each unit, however, is playas, drainageways, or flood plains in which inundation or flash flooding is a severe hazard. Urban development is more costly for the Pullman unit because of the high shrink-swell potential; for the Mobeetie-Tascosa unit because of the steep gravelly soil; and for the Weymouth-Vernon-Knoco unit because of the slope, the high shrink-swell potential, and the clayey soil. The steep, rough, rocky topography and very shallow to shallow soils of the Burson-Quinlan-Aspermont and Potter-Mobeetie units impose limitations, which are very difficult and costly to overcome. These two units have low potential for urban development.

Some map units can be developed for urban use at a lower cost than the soils of those mentioned in the preceding paragraph. Included are the Likes-Tivoli unit and portions of the Acuff- Paloduro-Olton and Veal-Mobeetie-Paloduro units, none of which are subject to flooding.

The potential is high for farming in the Pullman unit but low for urban development. This unit is identified as map unit number 2 on the general soil map at the back of this publication. Pullman soil is dominant. On this soil, the high shrink-swell potential, low strength, and the high risk of corrosion to uncoated steel pipe are limitations to nonfarm development. With proper design and construction of foundations, storm drainage systems, and roadbeds, these limitations can be overcome. It should be noted, however, that the potential is high for farming, particularly under irrigation.

The rough, rugged Burson-Quinlan-Aspermont and Potter-Mobeetie units have good potential for parks and recreation areas. The nearly vertical canyon walls, raw gorges, escarpments, and canyons provide some of the most scenic areas in the county. Some parts of these units are good for nature study areas and serve as habitat for many important wildlife species. Potential for wildlife is discussed in the section "Use and management of the soils."

The Pullman unit and the less sloping portions of the Acuff- Paloduro-Olton unit have high potential for irrigated specialty crops.

Soil information can be used as a guide in planning the orderly growth and development of the county. It is especially helpful in determining which land to allocate to each land use.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Amarillo fine sandy loam, 1 to 3 percent slopes, is one of several phases in the Amarillo series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Amarillo-Urban land complex is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Mobeetie-Tascosa association, rolling, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Clairemont and Mangum soils, channeled, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Urban land is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 3 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

AcA—Acuff loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on broad ridgetops in the Canadian Breaks. Slopes are smooth and convex. Areas are oval and range from 50 to 300 acres.

Typically, the surface layer is dark brown, neutral loam about 8 inches thick. The subsoil extends to a depth of 80 inches or more. From 8 to 30 inches is brown, moderately alkaline clay loam. From 30 to 44 inches is light brown, moderately alkaline, calcareous clay loam that is about 25 percent calcium carbonate. From 44 to 80 inches is light brown, moderately alkaline, calcareous sandy clay loam.

Under native range this soil is high in natural fertility. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Estacado, Olton, and Posey soils. Included soils make up less than 15 percent of any one mapped area.

The main use of this soil is rangeland. The production potential is medium. The climax plant community is mainly short grasses and lesser amounts of mid grasses and perennial forbs. Proper stocking and controlled grazing are needed.

Small areas of this soil are used as cropland, mainly nonirrigated. The principal crops are winter wheat and grain sorghum. The potential for row crops and small grain is high. Adequate amounts of crop residue on the surface and timely and limited tillage are effective in conserving moisture, slowing runoff, reducing the risk of soil blowing, and maintaining tilth. If the soil is irrigated, a well designed irrigation system, skillful water management, and fertilization are needed.

The potential is high for all urban use. Low strength, the only limiting factor, can be overcome through proper design and careful installation.

The capability subclass is IIe irrigated and IIIe nonirrigated. The range site is Clay Loam.

AcB—Acuff loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on broad ridgetops and side slopes along drains in the Canadian Breaks. Slopes are convex and average about 2 percent. Areas are long and oval and range from 10 to 300 acres.

Typically the surface layer is dark brown, neutral loam about 11 inches thick. The subsoil extends to a depth of

80 inches or more. From 11 to 52 inches is brownish clay loam that is neutral in the upper part and moderately alkaline and calcareous below. From 52 to 65 inches is pink, calcareous clay loam that is about 40 percent calcium carbonate. From 65 to 80 inches is reddish yellow, calcareous sandy clay loam.

Under native range this soil is high in natural fertility. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Estacado, Paloduro, and Posey soils. Included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is moderate. The climax plant community is mainly short grasses and small amounts of mid grasses and perennial forbs. Proper stocking and controlled grazing are needed.

A few small areas are used for winter wheat, grain sorghum, and forage sorghum, mainly nonirrigated. The potential for row crops and small grain is high. In places, terraces, contour farming, and waterways are needed to reduce the hazard of water erosion. Crop residue on the surface and timely and limited tillage are effective in conserving moisture, slowing runoff, reducing the risk of soil blowing, and maintaining tilth. If the soil is irrigated, a well designed irrigation system, good water management, and fertilization are needed.

The potential is high for all urban use. Low strength, the only limitation, can be overcome through proper design and careful installation.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Clay Loam.

AcC—Acuff loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on side slopes along draws in the Canadian Breaks. Slopes are convex. The gradient is dominantly 4 percent. Areas are long bands that range from 10 to 200 acres.

The surface layer is about 11 inches of dark brown, neutral clay loam. The subsoil extends to a depth of 80 inches or more. From 11 to 36 inches is reddish brown, moderately alkaline clay loam. From 36 to 64 inches is light brown, calcareous clay loam that is about 25 percent calcium carbonate. From 64 to 80 inches is reddish yellow, calcareous sandy clay loam.

Under native range this soil is high in natural fertility. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Estacado and Posey soils. Also included are a few small gravelly knolls of Tascosa soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is mainly short grasses and small amounts of mid grasses and forbs. Proper stocking and controlled grazing are needed.

A few small areas are used for winter wheat and forage sorghums, mainly nonirrigated. The potential for cultivated crops is medium. It is limited by the size of the field and by the slope. Terraces, waterways, and contour farming are needed to reduce the hazard of water erosion. Closely spaced high residue crops provide adequate cover and residue to protect the soil. Crop residue on the surface and minimum tillage are effective in conserving moisture, slowing runoff, reducing the risk of soil blowing, and maintaining tilth.

The potential is high for urban use. Low strength and the slope, the only limitations, can be overcome through proper design and careful installation.

The capability subclass is IVe irrigated and nonirrigated. The range site is Clay Loam.

AfB—Amarillo fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on broad ridgetops and side slopes along draws in the Canadian Breaks. Slopes are convex. The gradient is dominantly 2 percent. Most areas are long and oval and range from 20 to 800 acres.

Typically the surface layer is brown, mildly alkaline fine sandy loam about 9 inches thick. The subsoil extends to a depth of 80 inches or more. From 9 to 38 inches is a reddish brown, mildly alkaline sandy clay loam. From 38 to 80 inches is reddish yellow, calcareous clay loam that is about 30 percent calcium carbonate.

Under native range this soil is medium in natural fertility. Permeability is moderate, and available water capacity is medium. Runoff is medium. Unless the soil is protected, the hazards of water erosion and soil blowing are moderate.

Included in some mapped areas are small tracts of Estacado, Mobeetie, and Posey soils. These soils make up less than 15 percent of any one mapped area. Also included are a few eroded areas where the surface layer is thinner than is typical for this soil.

The acreage is mainly rangeland. The production potential is medium. Rangeland areas produce moderately dense stands of short grasses and lesser amounts of mid grasses and scattered shrubs. Proper stocking, controlled grazing, and brush control are needed.

A few areas are used for winter wheat, grain sorghum, and forage sorghum, mainly nonirrigated. The potential for cultivated crops is high. In places, terraces, waterways, and contour farming are needed to reduce the hazards of water erosion and soil blowing. Crop residue on the surface and minimum tillage are effective in conserving moisture, slowing runoff, reducing the risk of soil blowing, and maintaining tilth. If this soil is irrigated, a well designed irrigation system and good water management are needed.

The potential is high for urban uses. Low strength and the risk of corrosion, the only limitations, can be over-

come through proper planning, design, and careful installation.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Sandy Loam.

Am—Amarillo-Urban land complex. This complex consists of small areas of Amarillo soils and Urban land. It is on broad, gently sloping, convex ridges and side slopes along drains in the Canadian Breaks. Slopes range from 1 to 5 percent. Areas are generally oval and range from 40 to 200 acres.

About 55 percent of this complex is Amarillo fine sandy loam, about 35 percent is Urban land, and about 10 percent is other soils. These areas of soils and Urban land are so intricately mixed that mapping them separately is not practical.

The Amarillo soil has a surface layer of brown, mildly alkaline fine sandy loam about 9 inches thick. From 9 to 38 inches the subsoil is reddish brown, mildly alkaline sandy clay loam. From 42 to 80 inches it is reddish yellow, moderately alkaline, calcareous clay loam that is about 30 percent calcium carbonate.

This Amarillo soil is deep and well drained. Natural fertility in undisturbed areas is medium. Permeability is moderate, and available water capacity is medium. Runoff is medium. Unless the soil is protected by a plant cover, the hazards of water erosion and soil blowing are moderate.

The Urban land part of this complex is mostly occupied by single-unit dwellings, streets, driveways, sidewalks, commercial buildings, and schools. Few landscape alterations were made during urban development, except in cutting streets to grade. Some of the soils have a thin imported surface layer of loamy or clayey material.

Included in mapping are spots of Estacado, Mobeetie, and Posey soils. The included spots make up less than 15 percent of any one mapped area.

This complex is dominantly used as Urban land. The potential is high for all urban use, including home gardens, flowers, trees, and shrubs. Low strength, as it affects local roads and streets, is the only limitation. It can be overcome through careful design and installation.

Information on the use of this Amarillo soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

The soil is not assigned to a capability class or range site.

APD—Aspermont-Enterprise association, undulating. This association consists of deep, well drained soils in shallow valleys and on foot slopes below escarpments. Slopes are plane to convex. Gradients are 3 to 8 percent. Areas are narrow and irregularly shaped and range from 20 to 400 acres.

About 60 percent of this association is Aspermont soil, 25 percent is Enterprise soil, and 15 percent is other soils. Some individual areas of Aspermont and Enterprise soils are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The gently sloping Aspermont soil occupies foot slopes adjacent to drains and creeks. Typically, to a depth of 80 inches it is moderately alkaline, calcareous silty clay loam that is reddish brown in the upper part and yellowish red below.

Natural fertility of this Aspermont soil is medium. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of water erosion on denuded areas is moderate. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

Typically, the Enterprise soil is reddish brown, moderately alkaline, calcareous very fine sandy loam to a depth of more than 80 inches.

The Enterprise soil has a medium level of natural fertility. Permeability is moderately rapid, and the available water capacity is high. Runoff is rapid, and the erosion hazard in bare areas is severe. The risk of soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in mapping are a few areas of Clairemont and Yomont soils. These soils are on narrow flood plains. The included soils make up less than 15 percent of any one mapped area.

This association is used entirely as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and scattered shrubs. Proper stocking, controlled grazing, and brush control are needed.

The potential is low for farming. The size of areas, the slope, and inaccessibility are limitations that make farming impractical.

The potential is medium for urban use. The shrink-swell potential and low strength are limitations in the Aspermont soil. These limitations can be overcome through careful design and construction. Low strength, the only limitation of the Enterprise soil, can be offset through proper design and installation.

The capability subclass is VIe. The Aspermont soil is in the Clay Loam range site. The Enterprise soil is in the Sandy Loam range site.

AQF—Aspermont-Quinlan association, hilly. The gently rolling to hilly soils of this association are on an irregular series of small hills and ridges that have rounded crests and steep side slopes. The hills are separated by narrow drainageways, and geologic erosion is locally active. The Aspermont soil is on the lower side slopes and foot slopes, and the Quinlan soil is on the upper side slopes and crests of ridges and low hills. Slopes range from 10 to 30 percent. Areas are long bands that range from 30 to 500 acres but average about 200 acres.

About 50 percent of this association is Aspermont soil, 30 percent is Quinlan soil, and 20 percent is other soils.

Some individual areas of Aspermont and Quinlan soils are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The Aspermont soil in this association typically is moderately alkaline, calcareous silty clay loam to a depth of 80 inches. It is reddish brown in the upper part and red below.

Natural fertility is medium in this deep, well drained Aspermont soil. Permeability is moderate, and available water capacity is medium. Runoff is rapid and the hazard of water erosion is severe in overgrazed areas. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

The Quinlan soil typically is 14 inches of moderately alkaline, calcareous very fine sandy loam over red weakly cemented sandstone.

Natural fertility is low in this shallow, well drained to somewhat excessively drained soil. Permeability is moderately rapid, and available water capacity is very low. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted because the soil is shallow over rock.

Included in mapping are a few small areas of Burson and Knoco soils on steep upper side slopes. Also included are Clairemont and Yomont soils on a few narrow flood plains. These included soils make up less than 15 percent of any one mapped area.

This association is used entirely as rangeland and wildlife habitat. The production potential for rangeland is medium. The climax plant community is a mixture of short and mid grasses and scattered shrubs and trees. Proper stocking, controlled grazing, and brush control are needed.

This association is not suited to farming. The size of areas, complexity of slopes, and inaccessibility are limitations that make use of these soils for cropland impractical.

The potential is low for urban use. The slope, depth to rock, and shrink-swell potential are limitations that are difficult to overcome.

The capability subclass is VIe. The Aspermont soil is in Clay Loam range site. The Quinlan soil is in Loamy Prairie range site.

BcA—Bippus clay loam, 0 to 1 percent slopes. This deep, well drained soil is in smooth shallow valleys and on flood plains along streams. It is seldom flooded, but it receives runoff from adjoining soils. Slopes are nearly level and plane to concave. Areas are long and narrow and are parallel to the stream channels. They range from 10 to more than 100 acres; most are less than 50 acres.

Typically, the surface layer is dark grayish brown to very dark grayish brown, moderately alkaline, calcareous clay loam about 25 inches thick. The subsoil from 25 to 80 inches is moderately alkaline, calcareous clay loam that is brown in the upper part and yellowish red below.

Under native range this soil is high in natural fertility. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Spur soils. Included soils make up less than 20 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and scattered perennial forbs. Proper stocking, controlled grazing, and brush control are needed.

A few areas are used for winter wheat, grain sorghum, and forage sorghum, mainly nonirrigated. The potential for cultivated crops is high. The only limitation is the size and shape of soil areas. Effective in controlling erosion are suitable crop rotations, use of crop residue, and minimum tillage. In irrigated areas, a planned irrigation system, good water management, and fertilization are needed.

This soil is not suited to urban use. Flooding is the main limitation. It can be overcome only by major flood control measures.

The capability subclass is IIw irrigated and nonirrigated. The range site is Draw.

BcB—Bippus clay loam, 1 to 3 percent slopes. This deep, well drained soil is on valley fills and fans along draws. It is above the flood plain, but it receives extra runoff from adjoining sloping soils. Areas are long and narrow. They range from 20 to 200 acres but average about 30 acres. Slopes are smooth and in most places slightly concave.

Typically, the surface layer is dark grayish brown, moderately alkaline, calcareous clay loam about 21 inches thick. The subsoil is brown, moderately alkaline, calcareous clay loam that extends to more than 60 inches.

Under native range this soil is high in natural fertility. Permeability is moderate, and available water capacity is high. Runoff is medium. The hazard of water erosion is moderate in cultivated areas. The hazard of soil blowing is slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Acuff, Paloduro, and Spur soils. Included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and small amounts of perennial forbs. Proper stocking, controlled grazing, and brush control are needed.

A few small areas are used as cropland, mainly nonirrigated. The principal crops are winter wheat, grain sorghum, and forage sorghum. The production potential is high. The slope, shape of the areas, and proximity to nonarable soils, however, affect the use of this soil as cropland. Erosion control is needed—terracing and contour farming and in some places diversions and grassed waterways. Crop residue left on the surface and minimum tillage are effective in conserving moisture, slowing

runoff, reducing the risk of soil blowing, and maintaining tilth. If the soil is irrigated, a well designed irrigation system, good water management, and fertilization are needed.

The potential is medium for urban uses. Low strength and the shrink-swell potential are limitations. They can be overcome through good design and careful installation.

The capability subclass is IIe irrigated and nonirrigated. The range site is Draw.

Bd—Bippus and Spur soils, channeled. This map unit consists of deep, well drained, nearly level soils on flood plains 200 to 7,000 feet wide. These soils are subject to flooding two to three times each year, but the water quickly recedes and causes little damage to permanent vegetation. Bippus and Spur soils are closely associated, but the pattern is irregular. The Bippus soil is on low terraces, and the Spur soil is near stream channels.

A typical area of this map unit is about 50 percent Bippus soil, 45 percent Spur soil, and 5 percent scoured stream channel. Areas of these soils are not uniform and do not occur in a regular pattern.

Typically, the Bippus soil has a dark grayish brown, moderately alkaline, calcareous clay loam surface layer about 18 inches thick. The subsoil from 18 to 50 inches is brown, calcareous clay loam. From 50 to 62 inches is light brown, moderately alkaline, calcareous sandy clay loam. The underlying material to about 80 inches is light brown, moderately alkaline, calcareous fine sandy loam.

Natural fertility of this Bippus soil is high. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

Typically, the surface layer of this Spur soil is about 18 inches of dark brown, moderately alkaline clay loam. From 18 to 38 inches the subsoil is brown, calcareous clay loam. The underlying material from 38 to 80 inches is stratified, brownish, moderately alkaline clay loam.

Natural fertility of this Spur soil is high. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

This map unit is entirely rangeland. The production potential is medium. The climax plant community is a mixture of short grasses, mid grasses, and scattered perennial forbs. Proper stocking and controlled grazing are needed.

These soils are not suited to crops because of the hazard of flooding. They are also not suited to urban use. Flooding, the main limitation, can be overcome only by major flood control measures.

The capability subclass is Vw. The range site is Draw.

BQG—Burson-Quinlan-Rock outcrop association, steep. This association consists of well drained and somewhat excessively drained soil and Rock outcrop that occur in a regular pattern. The landscape (fig. 3) is mainly one of steep stony areas, canyon walls, and escarpments. Slopes are dominantly 30 to 70 percent, and geologic erosion is evident. In most areas, the surface is littered with fragments and boulders of limestone and sandstone. The Burson soil is on the steep side slopes, and the Quinlan soil is on narrow benches above the Rock outcrop. Areas are long and narrow and range from 30 to more than 1,000 acres.

About 30 percent of this association is Burson soil, 25 percent is Quinlan soil, 15 percent is Rock outcrop, and 30 percent is similar soils and unweathered shale. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The Burson soil typically has a red, moderately alkaline, calcareous loam surface layer about 6 inches thick. The underlying material to a depth of about 60 inches is red, very fine grained sandstone.

Natural fertility is low in this Burson soil. Permeability is moderate, and available water capacity is very low. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted because the soil is very shallow over rock.

The surface layer of the Quinlan soil is typically reddish brown, calcareous very fine sandy loam about 14 inches thick. Below this is red, weakly cemented calcareous sandstone.

Natural fertility of this shallow Quinlan soil is low. Permeability is moderate, and available water capacity is very low. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted because the soil is shallow over rock.

Included in mapping are areas of Knoco soils, Clairemont soils, on narrow flood plains, and Enterprise and Aspermont soils. The included soils make up about 30 percent of the acreage.

This association is used as rangeland and wildlife habitat. It supports only sparse vegetation, and the production potential is low. Some areas have limited accessibility for grazing by cattle but are used by deer and other wildlife. The climax plant community is a thin mixture of mid and tall grasses and scattered shrubs and trees.

This association is not suited to crops, and the potential for urban use is very low. Slope, restricted rooting depth, and large stones are severe limitations that are difficult to overcome.

The capability subclass is VIIs. The Burson soil is in Rough Breaks range site. The Quinlan soil is in Loamy Prairie range site. Rock outcrop is not assigned to a capability subclass or range site.

Cc—Clairemont silty clay loam, occasionally flooded. This deep, well drained, nearly level soil is on

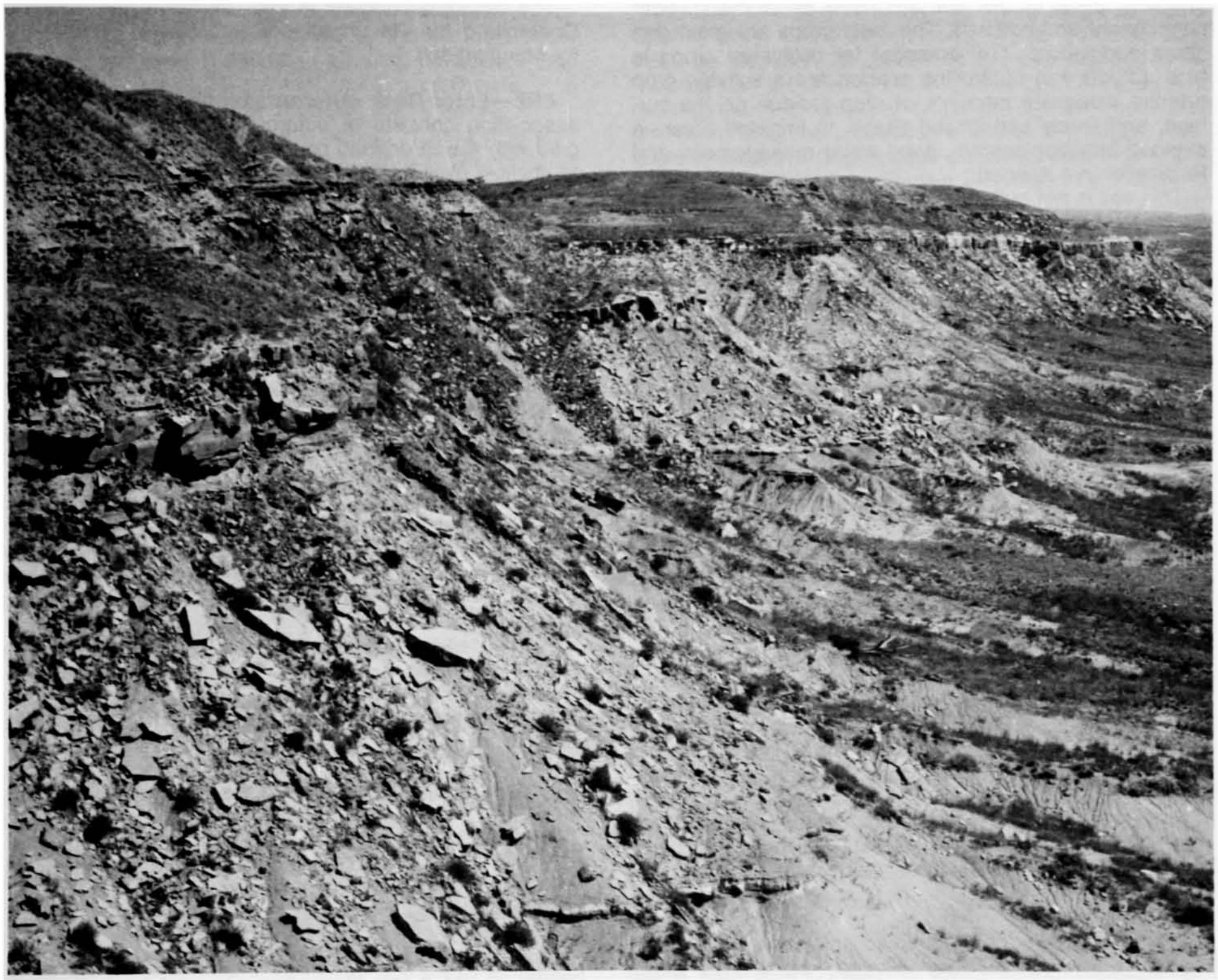


Figure 3.—Area of Burson-Quinlan-Rock outcrop association, steep.

narrow flood plains of small streams. It is flooded about once every 3 to 5 years. The water quickly recedes and causes little damage to permanent vegetation. Slopes are dominantly less than 0.5 percent but range up to 2 percent in places. Areas are long and narrow and parallel to the stream channels. They range from 10 to 300 acres but are mainly less than 100 acres.

Typically the surface layer is about 8 inches of reddish brown, moderately alkaline, calcareous silty clay loam. From 8 to about 60 inches is stratified yellowish red, light reddish brown, and reddish yellow, moderately alkaline, calcareous silty clay loam.

Under native range this soil is medium in natural fertility. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Lincoln, Mangum, Spur, and Yomont soils. These included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is high. The climax plant community is a mixture of mid and tall grasses and scattered shrubs and trees. Proper stocking and controlled grazing are needed.

A few areas of this soil are used as cropland, both nonirrigated and irrigated. The main crops are grain sorghum and wheat. The potential for cultivated crops is high. Effective in controlling erosion are a suitable crop rotation, adequate amounts of crop residue on the surface, and timely and limited tillage. In irrigated areas, a planned irrigation system, good water management, and fertilization are needed.

This soil is not suited to urban use. Flooding, the main limitation, can be overcome only by major flood control measures.

The capability subclass is IIw irrigated and nonirrigated. The range site is Loamy Bottomland.

Cm—Clairemont and Mangum soils, channeled. This map unit consists of deep, nearly level soils on flood plains along major streams and their tributaries. It is flooded about once every 1 to 5 years. The surface is irregular and in places is dissected by channel scars or partly filled old stream channels. Clairemont and Mangum soils are closely associated, but the pattern of occurrence is irregular. The well drained Clairemont soil is on smooth low terraces. The moderately well drained Mangum soil is in depressed barren areas.

A typical area of this unit is about 45 percent Clairemont soil, 35 percent Mangum soil, 10 percent Yomont soil, and 10 percent stream channels. Areas of these soils are not uniform and do not occur in a regular pattern.

Typically, the Clairemont soil has a light reddish brown, moderately alkaline, calcareous silt loam surface layer about 9 inches thick. From 9 to 60 inches is reddish yellow, moderately alkaline, calcareous silty clay loam.

Natural fertility of this Clairemont soil is medium. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

The surface layer of Mangum soils is about 9 inches of reddish brown, moderately alkaline, calcareous clay. From 9 to 60 inches is brown to light reddish brown, moderately alkaline, calcareous clay that is stratified.

This Mangum soil is moderately well drained. Natural fertility is medium. Permeability is very slow, and available water capacity is high. Runoff is slow, and some areas remain wet for long periods following rains. Deep cracks form when the soil is dry. The hazards of water erosion and soil blowing are slight. The root zone is restricted as a result of the dense clayey texture.

The acreage is entirely rangeland. The production potential is moderate. The climax plant community is a mixture of short and mid grasses and scattered shrubs and trees. Proper stocking and controlled grazing are needed.

These soils are not suited to farming and urban use. Flooding, the main limitation, can be overcome only by major flood control measures.

The capability subclass is Vw. The range site is Loamy Bottomland for Clairemont soil and Clayey Bottomland for Mangum soil.

ERE—Ector-Rock outcrop association, rolling. This association consists of outcrops of limestone intermingled with a well drained gravelly soil that is very shallow to shallow over hard limestone. The Ector soil and Rock outcrop occur in a regular and repeating pattern. The landscape is mainly one of convex ridges, steep side slopes, and narrow drains. Slopes are dominantly 5 to 16 percent. In most areas the surface is littered with fragments of limestone. Boulders occur in some places. The Ector soil is on ridgetops and steep side slopes above the Rock outcrop. The outcrop occurs as bands 5 to 10 feet wide that follow the approximate contour of the landscape. Areas are long and narrow and range from 20 to 500 acres.

About 65 percent of this association is Ector soil, 15 percent is Rock outcrop, and 20 percent is other soils. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The Ector soil typically has a brown, moderately alkaline, calcareous very gravelly loam surface layer about 11 inches thick over hard fractured limestone several feet thick.

Natural fertility of the Ector soil is low. Permeability of the surface layer is moderate. The underlying limestone is impervious except for cracks and fissures. Because these soils are very shallow to shallow, available water capacity is very low. Runoff is rapid, and the hazard of water erosion is severe in overgrazed or bare areas. The root zone is restricted because the soil is shallow over rock.

Included in mapping are small tracts of Bippus and Paloduro soils along draws and some areas of Ector soils that have slopes of as much as 30 percent. Small areas of these included soils make up less than 15 percent of any one mapped area.

This association is used as rangeland and wildlife habitat. It has a low production potential for rangeland. The climax plant community is a thin cover of short and mid grasses and a few scattered shrubs. Proper stocking, controlled grazing, and brush control are needed.

This association is not suited to farming, and the potential for urban use is very low. Slope, large stones, and shallowness over rock are limitations that are difficult to overcome.

The capability subclass is VIIs for Ector soil. The range site is Very Shallow. Rock outcrop is not assigned to a capability subclass or range site.

EsA—Estacado clay loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on plains around playas and along the outer margins of the High Plains. Slopes are smooth and plane to slightly convex. Most areas are oval. They range from 10 to 200 acres but average about 50 acres.

Typically the surface layer is brown, moderately alkaline, calcareous clay loam about 12 inches thick. From 12 to 60 inches is moderately alkaline, calcareous clay loam that is about 25 percent calcium carbonate. It is brown in the upper part and reddish yellow below.

Under native range this soil is high in natural fertility. The high lime content, however, causes chlorosis, or yellowing of the leaves, in some plants. Permeability is moderate, and available water capacity is medium. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in some areas are small tracts of Olton, Posey, and Pullman soils. The included soils make up less than 15 percent of any one mapped area.

Most areas are cropland, both nonirrigated and irrigated. The main crops are winter wheat, grain sorghum, and corn. The potential is medium for cultivated crops. Adequate amounts of crop residue on the surface and limited tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. If the soil is irrigated, a planned irrigation system is needed to conserve water and control erosion. Fertilizer is also needed. Some crops respond to applications of trace elements.

Some of the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and small amounts of forbs. Proper stocking and controlled grazing are needed.

This soil has high potential for most urban use. Surface texture, low strength, and the risk of corrosion are the main limitations. These limitations can be overcome through sound design and careful installation.

The capability subclass is IIe irrigated and IIIe nonirrigated. The range site is Clay Loam.

EsB—Estacado clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil occurs as bands on the side slopes of playas and near the outer margins of the High Plains. Slopes are convex. Areas range from 10 to 400 acres but are commonly less than 150 acres.

Typically the surface layer is about 12 inches of dark grayish brown to brown, moderately alkaline, calcareous clay loam. The subsoil extends to more than 80 inches. The upper 15 inches is brown, moderately alkaline, calcareous clay loam. The lower part is reddish yellow, moderately alkaline, calcareous clay loam that is about 25 percent calcium carbonate.

Under native range this soil is high in natural fertility. The high lime content, however, causes chlorosis, or yellowing of the leaves, in some plants. Permeability is moderate, and available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in mapped areas are small tracts of Acuff, Olton, Posey, and Pullman soils. These included soils make up less than 15 percent of any one mapped area.

About half the acreage is cropland, both irrigated and nonirrigated. The principal crops are winter wheat and grain sorghum. The production potential is medium. Adequate amounts of crop residue on the surface and timely and limited tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. Terraces, waterways, and contour farming are used to dispose of excess rainfall. If the soil is to be irrigated, a properly designed irrigation system and good water management are needed. Fertilizer is also needed. Some crops respond to applications of trace elements, such as iron.

Some of the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and small amounts of forbs. Proper stocking and controlled grazing are needed.

The potential is high for urban use. Surface texture, low strength, and the risk of corrosion are the main limitations. These limitations can be overcome by proper design and skillful installation.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Clay Loam.

EsC—Estacado clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on side slopes of playas and along creeks and draws. Slopes are convex. The dominant gradient is about 4 percent. Areas are long and oval and range from 10 to 200 acres.

Typically the surface layer is brown, moderately alkaline, calcareous clay loam about 9 inches thick. The subsoil extends to more than 60 inches. The upper 12 inches is light brown, moderately alkaline, calcareous clay loam. The lower part is light reddish brown, moderately alkaline, calcareous clay loam that is 20 to 50 percent visible calcium carbonate.

Under native range this soil is high in natural fertility. It has a high lime content. In some plants chlorosis, or yellowing of the leaves, is apparent because of a deficiency of trace elements such as iron. Permeability is moderate, and available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Paloduro, Posey, and Potter soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and a few forbs. Proper stocking and controlled grazing are needed.

A few small areas are used as cropland, mainly nonirrigated. The principal crops are winter wheat and grain sorghum. The potential for cultivated crops is moderate. Slope and the hazard of water erosion are the main

limitations. Skillful management is needed to control water erosion and soil blowing. Crop residue on the surface and minimum tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. Terraces, waterways, and contour farming are needed to dispose of excess rainfall. If this soil is to be irrigated, a planned irrigation system, good water management, and fertilization are needed.

The potential is high for most urban use. Surface texture, low strength, and the risk of corrosion are the main limitations. These limitations can be overcome through proper planning and construction.

The capability subclass is IVe irrigated and nonirrigated. The range site is Clay Loam.

Eu—Estacado-Urban land complex. This complex occupies side slopes around playas and ridgetops and side slopes in the Canadian Breaks. Slopes are convex and have gradients of 0 to 3 percent. Areas are oval and range from 10 to 200 acres.

About 45 percent of this complex is Estacado clay loam, 45 percent is Urban land, and 10 percent is other soils. These areas of soils and Urban land are so intricately mixed that mapping them separately is not practical.

The Estacado soil typically has a surface layer of brown, moderately alkaline, calcareous clay loam about 10 inches thick. From 10 to 25 inches is brown, moderately alkaline, calcareous clay loam. From 25 to 75 inches is reddish yellow, moderately alkaline, calcareous clay loam that is about 30 percent calcium carbonate.

Natural fertility of the undisturbed soil is high. The high lime content, however, causes chlorosis, or yellowing of the leaves, in some plants. Permeability is moderate, and the available water capacity is medium. Runoff is medium. The hazard of water erosion is moderate in disturbed areas. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

Urban land is mostly covered with single-unit dwellings, streets, driveways, sidewalks, small commercial buildings, and schools. Few landscape alterations were made during construction except in cutting streets to grade. In some areas the soils have a thin imported surface layer of loamy or clayey material. In other areas topsoil has been removed, and the limy subsoil is exposed.

Included in this complex are small areas of Acuff, Olton, Posey, and Pullman soils. These included soils make up less than 20 percent of any one mapped area.

This complex is dominantly Urban land. The potential is high for most urban use. Surface texture and low strength, the main limitations, can be overcome through proper planning and construction.

Information on the use of this Estacado soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

The soil is not assigned to a capability subclass or range site.

KBE—Knoco-Badland association, rolling. This association consists of a shallow to very shallow soil and barren outcrops of shaly and clayey red beds that occur in a regular pattern. The landscape is mainly one of nearly barren knolls, ridges, side slopes, and gullies (fig. 4). Slopes are 5 to 16 percent. Geologic erosion is active. Areas are dissected by numerous small drainageways that carry the water swiftly into larger creeks. The Knoco soil is on gently sloping ridgetops and strongly sloping side slopes. Badland is on escarpments and smoother severely eroded areas below escarpments. Mapped areas are irregular in shape and range from 20 to 500 acres.

About 44 percent of this association is Knoco clay, 37 percent is Badland, and 19 percent is other soils. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The Knoco soil has a reddish brown, moderately alkaline, calcareous clay surface layer about 5 inches thick. Below this is reddish brown clayey shale.

This soil and Badland have low natural fertility. Permeability is very slow, and available water capacity is low. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is slight. The root zone is restricted because the soil is very shallow to shallow over shale.

Included in mapping are small areas of the closely similar Owens soil, Vernon soil, and Clairemont soil on narrow flood plains. These included soils make up less than 20 percent of any one mapped area.

This association is used entirely as rangeland. The climax plant community is a mixture of short and mid grasses. The plant cover is very sparse, and the production potential is very low. Proper stocking and controlled grazing are needed.

This map unit is not suited to cropland. It has very low potential for urban use. Slopes, the shrink-swell potential, the low strength, and the clayey texture are limitations that are difficult to overcome.

The capability subclass is VIIs for Knoco soil. The range site is Shallow Clay. Badland is not assigned to a capability subclass or range site.

LAE—Latom-Rock outcrop association, rolling. This association consists of a well drained, shallow to very shallow soil and areas of Rock outcrop that occur in a regular pattern. The landscape is mainly one of convex ridges, strongly sloping side slopes, and narrow drains. Slopes are 5 to 16 percent. In some areas, sandstone boulders are on the surface. The Latom soil is on gently sloping to sloping convex ridges and side slopes above Rock outcrop. Rock outcrop is on strongly sloping to moderately steep escarpments and severely eroded foot slopes. Mapped areas are long and narrow and range from 20 to 300 acres.

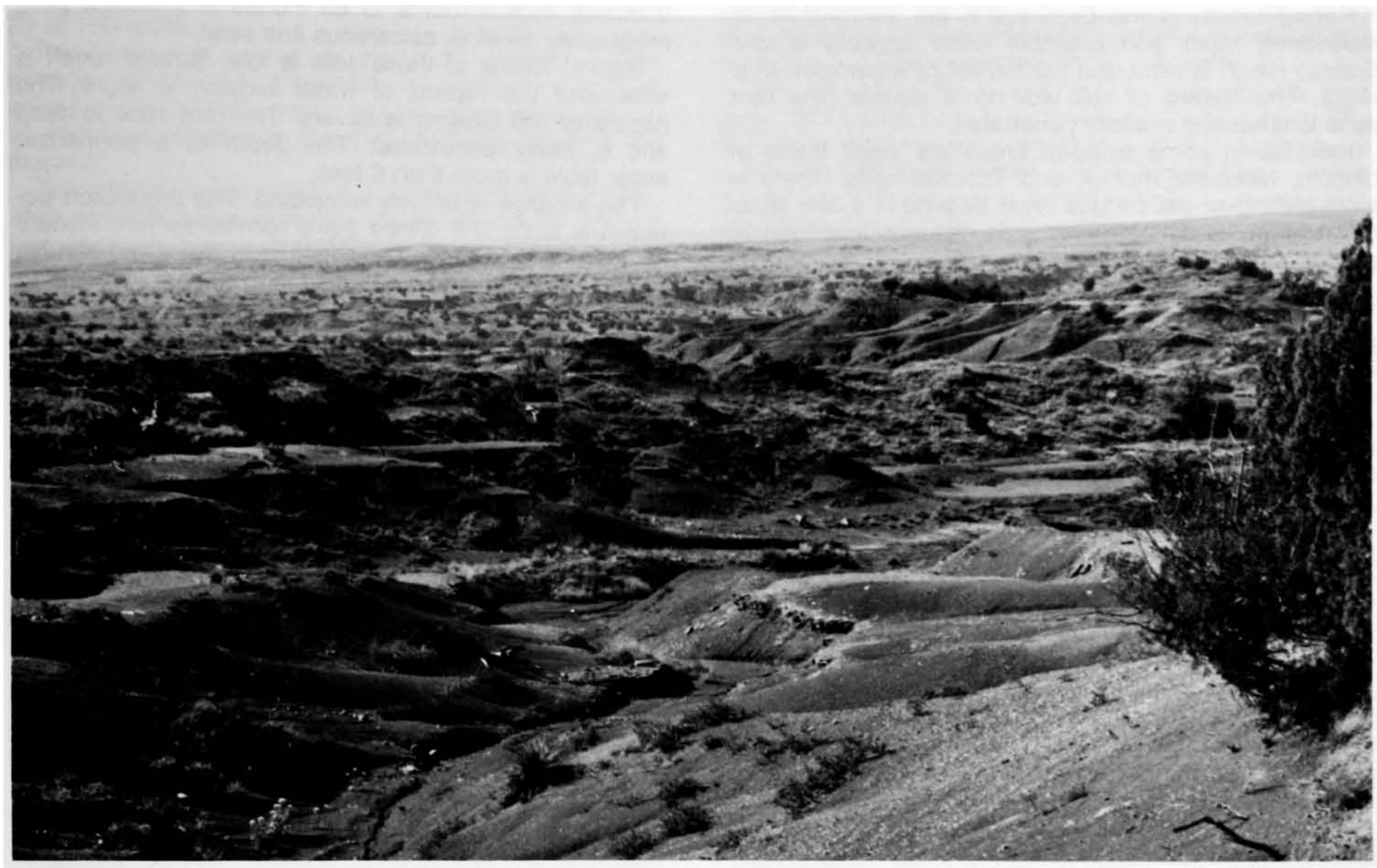


Figure 4.—Area of Knoco-Badland association, rolling.

This association is about 55 percent Rock outcrop, 32 percent Latom fine sandy loam, and 13 percent other soils. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The Latom soil typically has a grayish brown, moderately alkaline, calcareous fine sandy loam surface layer about 10 inches thick over strongly cemented, calcareous sandstone.

Natural fertility of the Latom soil is low. Permeability is moderate. Because this soil is very shallow to shallow, available water capacity is very low. Runoff is medium to rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted.

Included in mapping are small areas of Acuff, Posey, and Potter soils. These included soils make up less than 10 percent of any one mapped area.

This association is used entirely as rangeland. The production potential is low. The climax plant community is a sparse mixture of mid and tall grasses and scattered shrubs and yucca. Proper stocking and controlled grazing are needed.

This association is not suited to farming, and the potential for urban use is low. Slopes, large stones, and shallowness over rock are limitations that are difficult to overcome.

The capability subclass is VIIs for Latom soil. The range site is Very Shallow. Rock outcrop is not assigned to a capability subclass or range site.

LeD—Likes loamy fine sand, 1 to 8 percent slopes. This deep, excessively drained, undulating soil is on side slopes and foot slopes of hills and ridges. Areas are oval and range from 25 to 300 acres.

Typically, the surface layer is about 14 inches of grayish brown to brown, moderately alkaline, calcareous loamy fine sand. From 14 to 60 inches is moderately alkaline, calcareous loamy fine sand containing a few pebbles of quartz and concretions of calcium carbonate. It is pale brown in the upper part and yellowish brown below.

Natural fertility of this Likes soil is low. Permeability is moderately rapid, and available water capacity is low. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Lincoln, Mobeetie, Potter, and Tascosa soils. There is local shifting of the surface layer by wind in a few areas of 1 to 5 acres. The included soils make up less than 15 percent of any one mapped area.

The acreage of this Likes soil is entirely rangeland. The climax plant community is a mixture of mid and tall grasses and scattered shrubs. The production potential is high. Proper stocking and controlled grazing are needed.

This soil is not suited to cropland. The potential for urban use is high. The sandy texture and slope, the main limitations, can be overcome through proper planning and construction.

The capability subclass is VIe. The range site is Loamy Sand.

Lf—Lincoln soils, frequently flooded. This map unit consists of somewhat excessively drained, nearly level soils on flood plains along major streams (fig. 5). It is subject to flooding two or three times each year. The texture of the surface layer varies. These soils are not uniform and do not occur in a regular pattern. The surface layer is loamy fine sand, fine sand, fine sandy loam, or clay loam.

A typical area of this map unit is about 90 percent Lincoln soils and 10 percent Yomont soils.

Typically Lincoln soils have a light brown, moderately alkaline, calcareous loamy fine sand surface layer about 9 inches thick. From 9 to 60 inches is stratified, pink, moderately alkaline, calcareous fine sand.

Figure 5.—Area of Lincoln soils.

Natural fertility of these soils is low. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. The root zone is deep and is easily penetrated. The depth to a permanent water table is more than 6 feet.

The acreage is entirely rangeland. The production potential is high. The climax plant community is a mixture of mid and tall grasses and scattered trees and shrubs. Proper stocking and controlled grazing are needed to avoid overuse.

These soils are not suited to urban use or farming because of the hazard of flooding. Major flood control measures are needed.

The capability subclass is Vw. The range site is Sandy Bottomland.

Lh—Lipan clay. This deep, somewhat poorly drained, nearly level soil is on playa benches. Slopes are plane to slightly concave and have dominant gradients of less than 0.5 percent. Following heavy or prolonged rainfall, some areas are inundated for short periods. Areas are crescent shaped, partially encircling the playa basins. They range from 20 to 125 acres.

Typically this soil is gray, moderately alkaline, calcareous clay to 60 inches or more. It has common concretions of calcium carbonate in the lower part.

Natural fertility is medium. Permeability is very slow, and available water capacity is high. Runoff is slow to ponded, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included in some mapped areas are small tracts of Lofton and Randall soils. These included soils make up less than 20 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is high. The climax plant community is a mixture of short and mid grasses. Proper stocking and controlled grazing are needed to avoid overuse.

A few areas of this soil are used as nonirrigated cropland. The chief crops are grain sorghum and winter wheat. The potential is medium for cultivated crops. Periodic wetness is the main limitation. Managing crop residue on the surface is effective in controlling soil blowing and maintaining tilth. Grassed waterways and diversion terraces are needed in some places.

The potential is very low for urban use. Flooding, the main limitation, can be overcome only by costly flood control and drainage measures. The very high shrink-swell potential and low strength limitations can be overcome through proper design and construction.

The capability subclass is IIIw. The range site is Lakebed.

Ln—Lipan-Urban land complex. This complex consists of small areas of Lipan soils and Urban land. It occupies low, nearly level playa benches. Slopes are 0 to 1 percent. Following heavy or prolonged rainfall, some

areas are inundated for short periods. Areas range from 25 to 150 acres.

The Lipan soil makes up about 50 percent of this complex, Urban land 45 percent, and Lofton and Randall soils 5 percent. These areas of soils and Urban land are so intricately mixed that mapping them separately is not practical.

Typically the Lipan soil in this complex is gray, moderately alkaline, calcareous clay to 60 inches or more. It has common concretions of calcium carbonate in the lower part.

Natural fertility of the undisturbed Lipan soil is medium. Permeability is very slow, and the available water capacity is high. Surface runoff is slow to ponded, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

The Urban land part of this complex is mostly occupied by single-unit dwellings, streets, driveways, sidewalks, commercial buildings, schools, and churches. It includes some areas that have 1 to 6 feet of loamy and clayey fill material at the surface.

This complex is used as Urban land. It has a very low potential because of the hazard of flooding. The very high shrink-swell potential (fig. 6) and low strength are limitations that can be overcome through proper planning and construction.

Information on the use of this Lipan soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

This complex is not assigned to a capability class or range site.

Lo—Lofton clay loam. This deep, moderately well drained, nearly level soil is on playa benches. Slopes are plane to slightly concave and are 0 to 1 percent. Areas are generally crescent shaped, partially encircling the playa basin. They range from 25 to 150 acres.

Typically the surface layer is very dark gray to dark gray, mildly alkaline clay loam about 8 inches thick. The subsoil is a moderately alkaline clay that extends to more than 60 inches. The upper part is dark grayish brown, the middle part is grayish brown, and the lower part is pale brown with common concretions of calcium carbonate.

Natural fertility of this Lofton soil is high. Permeability is very slow, and available water capacity is high. Runoff is slow to very slow. Some areas remain wet for short periods following heavy or prolonged rainfall. The hazards of water erosion and soil blowing are slight.

Included in some mapped areas are small tracts of Lipan and Randall soils. The included soils make up less than 15 percent of any one mapped area.

Most areas of this soil are used for cropland, mainly nonirrigated. Most areas receive extra runoff from surrounding soils. The principal crops are grain sorghum, winter wheat, and corn. The potential is high for farming. Large amounts of crop residue on the surface are effective in conserving moisture, reducing the risk of soil blowing, and maintaining soil tilth. If the soil is irrigated, a well designed irrigation system, good water management, and fertilization are needed. In places, diversion terraces and grassed waterways are needed to handle excess runoff.

Some of the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses. Proper stocking and controlled grazing are needed.

The potential is low for urban use. Surface texture and the shrink-swell potential are the main limitations. Proper planning and construction can overcome these limitations.

The capability subclass is IIs irrigated and IIIe nonirrigated. The range site is Clay Loam.

Figure 6.—Effect of shrinking and swelling on sidewalk. The soil is Lipan clay.

Lu—Lofton-Urban land complex. This complex consists of small areas of Lofton soils and Urban land on low, nearly level playa benches. Slopes are 0 to 1 percent. Areas receive extra runoff from surrounding soils. Some are inundated for short periods after heavy rains. Areas range from 25 to 125 acres.

The Lofton soil makes up about 50 percent of this complex, Urban land 45 percent, and Lipan and Randall soils 5 percent. These areas of soils and Urban land are so intricately mixed that mapping them separately is not practical.

The Lofton soil typically has a surface layer of very dark gray to dark gray, mildly alkaline clay loam. The subsoil is moderately alkaline clay that extends to more than 60 inches. The upper part is dark grayish brown, the middle part is grayish brown, and the lower part is pale brown with common concretions of calcium carbonate.

Natural fertility is high in undisturbed areas of the Lofton soil. Permeability is very slow, and available water capacity is high. Runoff is slow to very slow. The hazards of water erosion and soil blowing are slight.

The Urban land part of this unit is mostly single-unit dwellings, streets, driveways, sidewalks, commercial buildings, churches, schools, parks, and shopping centers.

This complex is used as Urban land. The potential is low. Surface texture and the shrink-swell potential are the main limitations. Proper planning, design, and construction are needed.

Information on the use of this Lofton soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

This complex is not assigned to a capability class or range site.

Ma—Mangum clay, occasionally flooded. This deep, moderately well drained, nearly level soil is on terraces along major streams. Slopes range from 0 to 2 percent but are mainly less than 1 percent. In most areas the surface is a series of depressions and low mounds. The soil is subject to shallow, short duration flooding about once every 5 years. Floods cause little damage to permanent vegetation. Areas are irregular in shape and range from 10 to 200 acres.

Typically the surface layer is brown, moderately alkaline, calcareous clay about 9 inches thick. From 9 to 60 inches is stratified reddish brown, calcareous clay.

Natural fertility is medium. Permeability is very slow, and available water capacity is high. Surface runoff is slow. Some depressed areas remain wet for short periods following rains. The hazards of water erosion and soil blowing are slight.

Included in some mapped areas are small tracts of Clairemont and Yomont soils. Included soils make up less than 15 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is a sparse mixture of short and mid grasses. Careful management is needed to avoid overuse.

The potential is low for farming because of droughtiness. A few areas are used for nonirrigated wheat and grain sorghum. Adequate amounts of crop residue on the surface and minimum tillage are effective in conserving soil moisture and maintaining soil tilth.

The soil is not suitable for urban use because of flooding. Major flood control measures are needed. Surface texture and the shrink-swell potential are other limitations that can be overcome through proper planning and construction.

The capability subclass is IIIw. The range site is Clayey Bottomland.

MfB—Mobeetie fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on hills and ridges. Slopes are smooth and convex. Areas are oval and range from 15 to 100 acres.

Typically the surface layer is brown, calcareous fine sandy loam about 14 inches thick. From 14 to 80 inches is calcareous fine sandy loam that is reddish brown in the upper part and light reddish brown below.

Natural fertility is low. Permeability is moderately rapid, and available water capacity is moderate. Runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in some areas are small tracts of Acuff, Amarillo, and Veal soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is short and mid grasses and scattered shrubs. Proper stocking and controlled grazing are needed.

The potential is moderate for cropland. A few areas of this soil are nonirrigated wheat and grain sorghum. Terraces, grassed waterways, and contour farming are needed to control water erosion. An adequate amount of crop residue on the surface is effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. Timely and limited tillage is needed.

The potential is high for urban use. There are no significant limitations in constructing dwellings, small commercial buildings, and streets.

The capability subclass is IIIe, nonirrigated. The range site is Mixedland Slopes.

MfC—Mobeetie fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on side slopes and foot slopes. Slopes are plane to convex. Areas are long and oval and range from 10 to 100 acres.

The surface layer typically is brown, calcareous fine sandy loam about 10 inches thick. From 10 to 80 inches is calcareous light brown fine sandy loam that has a few films and threads of calcium carbonate.

Natural fertility is low. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate.

Included in some mapped areas are small tracts of Amarillo, Posey, and Potter soils. These included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is short and mid grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overuse and maintain production.

A few areas of this soil are nonirrigated wheat and grain sorghum. The potential is medium for farming. Terraces, contour farming, and grassed waterways are needed to control water erosion. Crop residue on the soil surface and minimum tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth.

There are no significant limitations in constructing dwellings, small commercial buildings, and streets. The potential is high for urban use.

The capability subclass is IVe. The range site is Mixedland Slopes.

MfD—Mobeetie fine sandy loam, 5 to 12 percent slopes. This deep, well drained, sloping to strongly sloping soil is on side slopes and foot slopes below escarpments. Slopes are plane to convex. Areas are long and narrow and range from 20 to more than 1,000 acres.

Typically this soil has a grayish brown, calcareous fine sandy loam surface layer about 9 inches thick. From 9 to 80 inches is brownish, calcareous fine sandy loam.

Natural fertility is low. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Likes, Potter, Tascosa, and Veal soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is used as rangeland. The production potential is medium. The climax plant community is short and mid grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overuse and maintain production.

Because the soil is strongly sloping, it is not suitable for cropland, but the potential is high for urban use. Slope, the only limitation, can be overcome through careful planning, design, and construction.

The capability subclass is VIe. The range site is Mixedland Slopes.

Mo—Mobeetie-Urban land complex. This complex consists of small areas of Mobeetie soils and Urban land on gently sloping side slopes and foot slopes. It occurs as long, oval shaped areas that range from 10 to 50 acres. Slopes are 1 to 5 percent.

The Mobeetie soil makes up about 55 percent of this complex and Urban land 35 percent. The remaining 10 percent is mainly Acuff, Amarillo, and Posey soils. These areas of soils and Urban land are so intricately mixed that mapping them separately is not practical.

Mobeetie soils typically have a surface layer of brown, calcareous fine sandy loam about 10 inches thick. From 10 to 60 inches is calcareous fine sandy loam that is light brown in the upper part and pale brown below.

Natural fertility is low in undisturbed areas of this Mobeetie soil. Permeability is moderately rapid, and available water capacity is moderate. Runoff is medium. Unless the soil is protected by a plant cover, the hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Urban land consists mainly of single-unit dwellings, streets, driveways, sidewalks, commercial buildings, shopping centers, and schools.

This complex is used as Urban land. The potential is high for urban use. There are no significant limitations for dwellings, streets, or small commercial buildings. Most shrubs, trees, flowers, and vegetables can be grown successfully.

Information on the use of this Mobeetie soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

This complex is not assigned to a capability class or range site.

MTE—Mobeetie-Tascosa association, rolling. This association occupies smooth low knolls, hills, and ridges that have rounded crests and strongly sloping to moderately steep side slopes. These hills are separated by narrow, branching drainageways. Slopes are mainly convex, and gradients are 5 to 16 percent. The deep, well drained Mobeetie soil is on lower side slopes and foot slopes. The shallow, well drained gravelly Tascosa soil is on ridgetops and upper side slopes. Mapped areas of this association are oval and range from 50 to more than 1,000 acres.

This association is about 50 percent Mobeetie soil, 30 percent Tascosa soil, and 20 percent other soils. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The Mobeetie soil typically has a grayish brown, calcareous fine sandy loam surface layer about 9 inches thick. From 9 to 41 inches is pale brown, calcareous fine sandy loam. From 41 to 60 inches is very pale brown, calcareous fine sandy loam.

Natural fertility of this Mobeetie soil is low. Permeability is moderately rapid, and the available water capacity is medium. Surface runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate in unprotected areas. The root zone is deep and is easily penetrated.

Typically the surface layer of the Tascosa soil is about 9 inches of brown, moderately alkaline very gravelly sandy loam. From 9 to 15 inches is grayish brown, moderately alkaline, calcareous very gravelly sandy loam. From 15 to 50 inches is light yellowish brown, moderately alkaline, calcareous very gravelly sandy loam.

Natural fertility is medium in the surface layer of this Tascosa soil. Permeability is moderate, and available water capacity is low. Surface runoff is rapid. The hazards of water erosion and soil blowing are slight.

Included in mapping are small areas of Paloduro, Potter, and Veal soils. Included soils make up less than 15 percent of any one mapped area.

This association is used entirely as rangeland. The production potential is medium. The Tascosa soil supports a sparse climax plant community of short and mid grasses, whereas Mobeetie soil has a good stand of short and mid grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overuse.

This association is not suitable for cropland because of the slopes and gravel.

The potential is low for urban uses. Slopes and gravel or small stones are limitations that are difficult to overcome.

The capability subclass is VIe for Mobeetie soil. The range site is Mixedland Slopes. The capability subclass is VIs for Tascosa soil. The range site is Gravelly.

MVE—Mobeetie-Veal association, rolling. This association consists of deep, well drained soils on smooth low hills and ridges that have gently sloping to strongly sloping side slopes. These hills and ridges are separated by narrow, branching drainageways. Slopes are convex, and gradients are commonly 5 to 16 percent. The Mobeetie soil is on the foot slopes and lower side slopes. The Veal soil is on the ridgetops and upper side slopes. Mapped areas of this association are irregular in shape and range from 50 to 600 acres.

This association is about 60 percent Mobeetie soil, 25 percent Veal soil, and 15 percent other soils. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

Typically the surface layer of this Mobeetie soil is brown, calcareous fine sandy loam about 10 inches thick. From 10 to 40 inches is light brown, calcareous fine sandy loam. From 40 to 60 inches is reddish yellow, calcareous fine sandy loam.

Natural fertility of this Mobeetie soil is low. Permeability is moderately rapid, and available water capacity is low. Surface runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

Typically this Veal soil has a brown, moderately alkaline, calcareous loam surface layer about 6 inches thick. From 6 to 14 inches is light brown, moderately alkaline, calcareous clay loam. From 14 to 60 inches is pink to pinkish gray, moderately alkaline, calcareous clay loam that is about 45 percent calcium carbonate.

Natural fertility of the Veal soil is low. Permeability is moderate, and available water capacity is moderate. Surface runoff is medium. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

Included in mapping are small areas of Bippus, Likes, Paloduro, and Potter soils. These included soils make up less than 15 percent of any one mapped area.

This association is used entirely as rangeland. The production potential is medium. The climax plant community is mid and short grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overuse.

This association is not suitable for farming because of the slope.

The potential for urban use is medium. Slope, excess lime, and low strength are limitations that can be overcome by proper planning, design, and construction.

The capability subclass is VIe. The range site is Mixedland Slopes for Mobeetie soil and Loamy for Veal soil.

OcA—Olton clay loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is near playas and broad divides on the margins of the High Plains. Slopes are smooth and slightly convex. Areas are oval and range from 25 to 600 acres.

Typically the surface layer is brown, neutral clay loam about 8 inches thick. From 8 to 32 inches is brown, mildly alkaline clay loam. From 32 to 80 inches is reddish yellow, calcareous clay loam that is about 50 percent calcium carbonate.

Natural fertility is high. Permeability is moderately slow, and available water capacity is high. Surface runoff is slow. The hazards of water erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Acuff, Amarillo, Estacado, and Pullman soils. These included soils make up less than 10 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is short grasses and small amounts of mid grasses and forbs. Proper stocking and controlled grazing are needed to prevent overuse.

A few areas of this soil are used as cropland, mainly nonirrigated. The principal crops are winter wheat, grain sorghum, and corn. The potential is high for cultivated crops. Adequate amounts of crop residue on the surface and timely and limited tillage are effective in conserving moisture, controlling soil blowing, and maintaining tilth. If the soil is irrigated, a properly designed irrigation system, good water management, and fertilization are also needed.

The potential is medium for urban use. Clayey texture, low strength, and shrink-swell potential are limitations but can be overcome through sound planning, design, and careful construction.

The capability subclass is IIe irrigated and IIIe nonirrigated. The range site is Clay Loam.

OcB—Olton clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil occurs along drains, above playas and ridges on the margins of the High Plains. Slopes are plane to concave. Areas are long and oval and range from 20 to 500 acres.

Typically the surface layer is about 10 inches of dark brown, mildly alkaline clay loam. The subsoil extends to a depth of 70 inches or more. The upper 45 inches is reddish brown, mildly alkaline clay loam. The next 19 inches is yellowish red, moderately alkaline, calcareous clay loam that is about 30 percent calcium carbonate. The lower 6 inches is reddish yellow, moderately alkaline, calcareous clay loam.

Natural fertility is high. Permeability is moderately slow, and available water capacity is high. Surface runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight. The root zone is deep and is easily penetrated.

Included in a few mapped areas are a few small tracts of Acuff, Amarillo, Estacado, and Pullman soils. These

included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is mainly a dense cover of short grasses and a small amount of mid grasses and forbs. Proper stocking and controlled grazing are needed to prevent overuse.

Some areas of this soil are used as cropland, mainly nonirrigated. The chief crops are winter wheat, grain sorghum, and corn. The production potential is high. Terraces, waterways, and contour farming are needed to reduce the hazard of water erosion. Crop residue on the surface and minimum tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. If the soil is irrigated, a planned irrigation system, water management, and fertilization are needed.

The potential is medium for urban uses. Low strength and the shrink-swell potential, the main limitations, can be overcome through proper planning, design, and construction.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Clay Loam.

Ou—Olton-Urban land complex. This complex consists of small areas of nearly level to gently sloping Olton soils and Urban land on ridgetops and plains. Slopes are dominantly less than 3 percent. Areas are oval and range from 30 to 100 acres.

The Olton soil makes up about 50 percent of this complex, Urban land 40 percent, and mainly Acuff, Estacado, Posey, and Pullman soils 10 percent. These areas of soils and Urban land are so intricately mixed that mapping them separately is not practical.

The Olton soil typically has a surface layer of neutral clay loam about 10 inches thick. The subsoil to a depth of 45 inches is reddish brown, mildly alkaline clay loam. From 45 to 80 inches is yellowish red, calcareous clay loam that is about 35 percent calcium carbonate in the lower part.

Natural fertility of this Olton soil is high. Permeability is moderately slow, and available water capacity is high. Surface runoff is slow to medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight. The root zone is deep and is easily penetrated.

Urban land consists mainly of single-unit dwellings, streets, driveways, sidewalks, small commercial buildings, and schools.

This complex is used entirely as Urban land. The potential is medium for urban use. Clayey texture, the shrink-swell potential, and low strength are the main limitations. They can be offset by sound planning and design and skillful construction.

Information on the use of this Olton soil for urban planning is given in the sections on engineering, town and country planning, and recreation.

This complex is not assigned to a capability class or range site.

PaB—Paloduro clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on ridges and side slopes along draws. Slopes are dominantly convex. Areas are long and narrow and range from 10 to 200 acres.

Typically this Paloduro soil has a brown, moderately alkaline, calcareous clay loam surface layer about 10 inches thick. The subsoil is moderately alkaline, calcareous clay loam that extends to 80 inches or more. It is brown in the upper part and light brown with films and threads of calcium carbonate in the lower part.

Natural fertility is high. The permeability is moderate, and available water capacity is high. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Acuff, Bippus, and Mobeetie soils. These included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is mainly a mixture of short and mid grasses and a few scattered shrubs. Proper stocking and controlled grazing are needed to prevent overuse.

A few areas of this soil are used as nonirrigated cropland. The principal crops are winter wheat, grain sorghum, and forage sorghums. The potential is medium for cultivated crops. Good management is needed to control soil blowing and water erosion. Terraces, grassed waterways, and contour farming are needed. Adequate amounts of crop residue on the surface in addition to timely and limited tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. If the soil is irrigated, a planned irrigation system, good water management, and fertilization are needed.

The potential is high for most urban uses. Clayey surface texture as it affects recreational development is the only limitation. This limitation can be easily offset by proper planning procedures.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Hardland Slopes.

PaC—Paloduro clay loam, 3 to 5 percent slopes. This deep, well drained soil is on foot slopes below escarpments and side slopes along draws. It occurs as long narrow bands that range from 20 to 250 acres.

Typically the surface layer is dark brown, moderately alkaline, calcareous clay loam about 12 inches thick. The subsoil to a depth of 80 inches is brown, calcareous clay loam that contains a few threads and films of calcium carbonate.

Natural fertility is high. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in mapping are a few small areas of Acuff, Bippus, Mobeetie, and Potter soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is short and mid grasses and a few scattered forbs. Proper stocking and controlled grazing are needed.

A few areas of this soil are used for nonirrigated winter wheat and sorghums. The potential is low for use as cropland. Slope and the hazard of water erosion are the main limitations. Skillful management is needed to control water erosion and soil blowing. Crop residue left on the surface and minimum tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth. Terraces, grassed waterways, and contour farming are also needed to dispose of excess rainfall. If this soil is irrigated, a planned irrigation system, skillful water management, and fertilization are needed.

The potential is high for most urban uses. The clayey surface texture as it affects recreational development and the low strength in roadfill, the only limitations, can be offset through proper planning, design, and construction.

The capability subclass is IVe irrigated and nonirrigated. The range site is Hardland Slopes.

PaD—Paloduro clay loam, 5 to 8 percent slopes. This deep, well drained soil is on foot slopes below the caprock escarpment and sloping side slopes along draws. Slopes are plane to convex. Areas are long narrow bands that range from 10 to 200 acres.

Typically the surface layer is dark brown, moderately alkaline, calcareous clay loam about 11 inches thick. From 11 to 80 inches is moderately alkaline, calcareous brown clay loam that has threads and films of calcium carbonate.

Natural fertility of this Paloduro soil is high. Permeability is moderate, and available water capacity is high. Surface runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in mapping are a few small areas of Bippus, Posey, and Potter soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is used entirely as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses. Proper stocking and controlled grazing are needed.

This soil is not suitable for use as cropland because of the slope and the hazard of water erosion.

The potential is high for most urban uses. The slope as it affects construction of small commercial buildings, the clayey surface texture, and the low strength in roadfill are the main limitations. Proper planning and design and careful construction can easily offset these limitations.

The capability subclass is VIe. The range site is Hardland Slopes.

PcB—Posey clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on ridgetops and side slopes of playas and along draws. Slopes are convex. Areas are long and oval and range from 20 to 100 acres.

Typically the surface layer is brown clay loam about 7 inches thick. The subsoil to 18 inches is reddish brown clay loam. Below this to a depth of 80 inches is yellowish red, calcareous clay loam that is about 25 percent calcium carbonate. This soil is moderately alkaline and calcareous throughout.

Natural fertility is medium. Permeability is moderate, and the available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The high lime content of this soil causes chlorosis, or yellowing of the leaves, in some plants. The root zone is deep and is easily penetrated.

Included in some mapped areas are small tracts of Acuff, Estacado, and Potter soils. These included soils make up less than 20 percent of any one mapped area.

The acreage is mainly rangeland (fig. 7). The production potential is medium. The climax plant community is mainly mid and short grasses and a few scattered shrubs and forbs. Proper stocking and controlled grazing are needed.

A few areas are used as cropland, mainly nonirrigated winter wheat. A few irrigated areas are in grain sorghum and corn. The potential is medium for cultivated crops. Good management is needed to control water erosion and soil blowing. Residue producing crops, managing residue, minimum tillage, and contour farming and terracing are effective in protecting the soil. Stubble mulching is the best form of residue management. If the soil is irrigated, a well planned irrigation system and water management are needed. Fertilizer is also needed. Some crops respond to trace elements such as iron.

The potential is high for most urban uses. Excess lime as it affects plants, the risk of corrosion, and the clayey surface texture are the only limitations.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Loamy.

PcC—Posey clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on side slopes along creeks and draws. Slopes are smooth and convex. Areas are long and narrow and range from 15 to 200 acres.

The surface layer is brown, moderately alkaline, calcareous clay loam about 8 inches thick. From 8 to 17 inches is light brown, moderately alkaline, calcareous clay loam. Below this to a depth of 80 inches is a light reddish brown, moderately alkaline, calcareous clay loam that is about 30 percent calcium carbonate.

Natural fertility is medium. Permeability is moderate, and available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The high lime con-

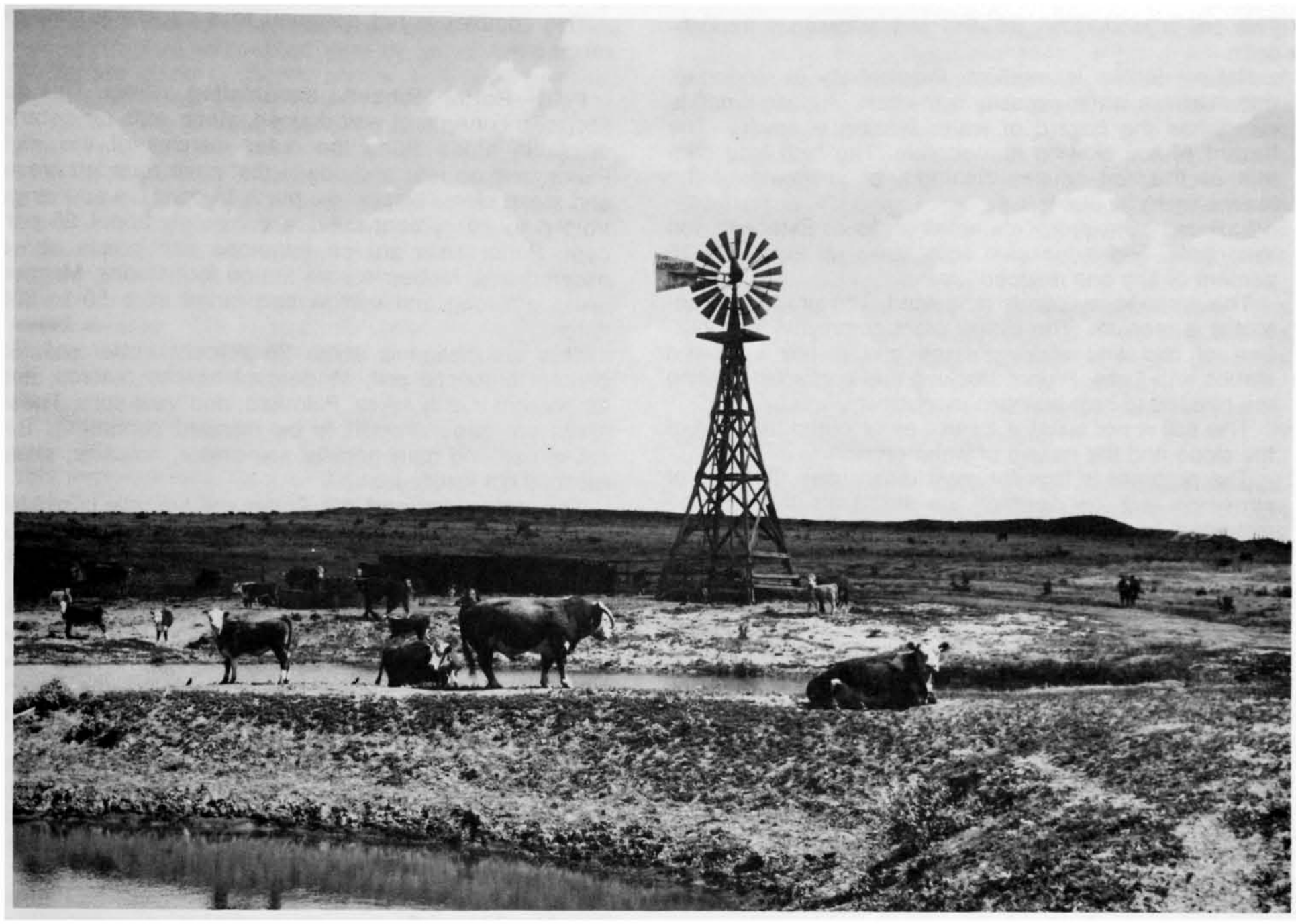


Figure 7.—Hereford cattle at windmill. The soil is Posey loam.

tent causes deficiencies of trace elements such as iron in some plants. The root zone is deep and is easily penetrated.

Included in mapping are a few small areas of Bippus, Estacado, Paloduro, and Potter soils. The included soils make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is mid and short grasses and scattered shrubs and forbs. Proper stocking and controlled grazing are needed to maintain productivity.

A few areas of this soil are used as cropland, mainly nonirrigated. The principal crop is winter wheat, which is also grazed by livestock. Because of slope and the hazard of water erosion, the potential is low for use as cropland. Terraces, contour farming, and careful management of crop residue are needed to control water erosion and soil blowing. If this soil is irrigated, a closely spaced crop that produces large amounts of residue should be grown continuously.

The potential is high for urban uses. The risk of corrosion and low strength, the main limitations, can be offset by proper planning and special construction techniques.

The capability subclass is IVe irrigated and nonirrigated. The range site is Loamy.

PcD—Posey clay loam, 5 to 8 percent slopes. This deep, well drained sloping soil is along creeks and draws. The slopes are convex. Areas are long and narrow and range from 10 to 100 acres.

Typically the surface layer is about 7 inches of light brown clay loam. The subsoil extends to a depth of about 80 inches. It is reddish brown clay loam in the upper part and light reddish brown clay loam that is about 35 percent calcium carbonate in the lower part.

This soil is moderately alkaline and calcareous throughout.

Natural fertility is medium. Permeability is moderate, and available water capacity is medium. Surface runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The high lime content of this soil causes chlorosis, or yellowing of the leaves, in some plants.

Included in mapping are small areas of Estacado and Veal soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is entirely rangeland. The production potential is medium. The climax plant community is a mixture of mid and short grasses and a few scattered shrubs and forbs. Proper stocking and controlled grazing are needed to help maintain productivity.

This soil is not suitable for use as cropland because of the slope and the hazard of water erosion.

The potential is high for most urban uses. The risk of corrosion and low strength are limitations that can be overcome through sound planning and construction.

The capability class is VIe. The range site is Loamy.

Pe—Posey-Urban land complex. This complex consists of small areas of gently sloping to sloping Posey soils and Urban land on ridgetops and on side slopes along draws. Slopes range from 1 to 8 percent. Areas are long and range from 20 to 200 acres.

About 45 percent of this complex is Posey soil, 45 percent Urban land, and 10 percent mainly Acuff, Estacado, and Olton soils. Areas of these soils and Urban land are so intricately mixed that mapping them separately is not practical.

The Posey soil typically has a brown, clay loam surface layer about 8 inches thick. From 8 to about 20 inches is light brown clay loam. From 20 to 80 inches is reddish yellow clay loam that is about 30 percent calcium carbonate in the lower part. The soil is moderately alkaline and calcareous throughout.

Natural fertility is medium in undisturbed areas of this Posey soil. Permeability is moderate, and available water capacity is medium. Surface runoff is medium to rapid. Unless the soil is protected by a plant cover, the hazard of water erosion is severe. The hazard of soil blowing is moderate. The high lime content causes chlorosis in some plants.

The Urban land part of this complex is mostly occupied by single-unit dwellings, streets, driveways, sidewalks, small commercial buildings, parks, and schools. Most open areas have a thin imported surface layer of loamy or clayey material.

This complex is used as Urban land. The potential is high for most urban uses. The clayey surface texture, slope, low strength, and risk of corrosion are minor limitations for some uses. These limitations can be overcome through proper planning, design, and construction.

Information on the use of this Posey soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

This complex is not assigned to a capability class or range site.

PMG—Potter-Mobeetie association, steep. This association consists of well drained, steep soils on escarpments in areas along the outer margins of the High Plains, and on hills and ridges that have rounded crests and steep sides. Slopes are plane to concave and range from 5 to 30 percent but are commonly about 25 percent. Potter soils are on ridgetops and crests above escarpments. Mobeetie soils are on foot slopes. Mapped areas are long and narrow and range from 50 to 500 acres.

This association is about 35 percent Potter soil, 30 percent Mobeetie soil, 15 percent caliche outcrop, and 20 percent mainly Likes, Paloduro, and Veal soils. These areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The surface layer of this Potter soil typically is pinkish gray, moderately alkaline, calcareous gravelly loam about 9 inches thick. From 9 to 60 inches is a pink, slightly platy caliche bed.

Natural fertility of this Potter soil is low. Permeability is moderate in the surface layer and variable in the underlying material. The available water capacity is very low. Runoff is rapid. Unless this soil is protected, the hazard of water erosion is severe. The root zone is restricted because the soil is shallow over caliche.

This Mobeetie soil typically has a surface layer of light brown fine sandy loam about 7 inches thick. From 7 to 40 inches is pinkish gray fine sandy loam. From 40 to 60 inches is pink fine sandy loam. The soil is moderately alkaline and calcareous throughout.

Natural fertility of this Mobeetie soil is medium. Permeability is moderately rapid, and available water capacity is medium. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The soil has a deep root zone and is easily penetrated.

This association is entirely rangeland. The production potential is low. The climax plant community on the Potter soil is a thin cover of mid and short grasses and scattered shrubs. The climax plant community on the Mobeetie soil is mid and short grasses, scattered shrubs, and a few tall grasses. Proper stocking and controlled grazing are needed to prevent overuse and maintain productivity.

This association is not suited to crops and has very low potential for urban use. Slope, depth to rock, and gravel or small stones are limitations that are difficult to offset.

The capability subclass is VIIs. The range site is Very Shallow for Potter soil and Mixedland Slopes for Mobeetie soil.

PuA—Pullman clay loam, 0 to 1 percent slopes. This deep, well drained soil is on broad smooth plains.

Most areas extend in a continuous pattern over several thousand acres, interrupted only by playa depressions. Slopes are plane to slightly convex and have dominant gradients of about 0.5 percent.

Typically, the surface layer is brown, neutral clay loam about 7 inches thick. From 7 to 33 inches is dark brown, mildly to moderately alkaline clay. From 33 to 54 inches is moderately alkaline, calcareous reddish brown clay. From 54 to 80 inches is pink, calcareous clay loam that is about 30 to 50 percent calcium carbonate.

Natural fertility is high. The soil is very slowly permeable and has a medium available water capacity. Surface runoff is slow. The hazards of water erosion and soil blowing are slight. The soil has a deep root zone that is not easily penetrated by plant roots because of the clayey texture.

Included in mapping are a few small areas of Estacado, Olton, Posey, and Randall soils. These included soils make up less than 10 percent of any one mapped area.

This soil is mainly used as cropland, both nonirrigated and irrigated (fig. 8). The potential is high. The principal crops are winter wheat, grain sorghum, and corn. Crop residue left on the surface and minimum tillage are effective in conserving moisture, controlling soil blowing, and maintaining tilth. If the soil is irrigated, a planned irrigation system, good water management, and fertilization are needed.

Figure 8.—Furrow irrigation on Pullman clay loam, 0 to 1 percent slopes.

Some of the acreage is rangeland. The production potential is medium. The climax plant community is mainly short grasses and a small amount of mid grasses and forbs. Proper stocking and controlled grazing are effective in maintaining productivity.

The soil has low potential for most urban uses. The shrink-swell potential, low strength, and risk of corrosion are the main limitations. Sound planning, adequate design, and careful construction are needed.

The capability subclass is IIs irrigated and IIIe nonirrigated. The range site is Clay Loam.

PuB—Pullman clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is near playas and on side slopes along draws. Slopes are smooth and slightly convex. Areas are long and narrow and range from 10 to 350 acres.

Typically the surface layer is brown, mildly alkaline clay loam about 6 inches thick. The subsoil extends to a depth of 72 inches or more. The upper part is dark brown, moderately alkaline clay. The middle part is brown, calcareous clay loam. The lower part, from about 42 to 72 inches, is yellowish red, calcareous clay loam that is about 25 percent calcium carbonate masses and concretions.

Natural fertility is high. Permeability is very slow, and available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The soil has a deep root zone that is not easily penetrated by plant roots because of the clayey texture.

Included in some mapped areas are a few small tracts of Estacado, Olton, Posey, and Randall soils. These included soils make up less than 10 percent of any one mapped area.

This soil is mainly used for nonirrigated wheat and grain sorghum. A few areas are irrigated. The potential is high for crops. Adequate crop residue on the surface and minimum tillage are effective in controlling water erosion and conserving soil moisture. Terraces, waterways, and contour farming are needed to control runoff. If the soil is irrigated, a well designed irrigation system and good water management are needed. Most crops respond well to applications of fertilizer.

Some of the acreage is rangeland. The production potential is medium. The climax plant community is mainly a short grass prairie and small amounts of mid grasses and forbs.

The potential is low for most urban uses. The shrink-swell potential, low strength, and risk of corrosion are the chief limitations. Good planning, adequate design, and skillful construction are needed.

The capability subclass is IIIe irrigated and nonirrigated. The range site is Clay Loam.

Px—Pullman-Urban land complex. This complex consists of small areas of nearly level to gently sloping Pullman soil and Urban land. It occupies plains. It is the major part of the city of Amarillo. Slopes range from 0 to 3 percent but are dominantly less than 1 percent.

This complex is about 55 percent Pullman clay loam, 35 percent Urban land, and 10 percent Estacado, Olton, and Randall soils. Areas of these soils are so intermingled that mapping them separately is not practical.

The Pullman soil typically has a surface layer of brown, neutral clay loam about 8 inches thick. From 8 to about 30 inches is dark brown, mildly alkaline clay. From 30 to 50 inches is reddish brown calcareous clay. From 50 to about 80 inches is pink, calcareous clay loam that is about 30 percent calcium carbonate.

Natural fertility of this Pullman soil is high. Permeability is very slow, and available water capacity is medium. Surface runoff is slow to medium. The hazard of water erosion is moderate in unprotected areas. The hazard of soil blowing is slight. The root zone is deep and is easily penetrated.

The Urban land part of this complex is mostly single-unit dwellings, highways, streets, driveways, sidewalks, small commercial buildings, shopping centers, parks, and schools.

This complex is used as Urban land. The potential is low for most urban uses. The clayey texture, shrink-swell potential, low strength, and risk of corrosion are the main limitations. These limitations can be overcome with sound planning, design, and installation.

Information on the use of this Pullman soil for urban planning is given in the sections on engineering, town and country planning, and recreation in this publication.

This complex is not assigned to a capability class or range site.

Ra—Randall clay. This deep, somewhat poorly drained soil is at the bottom of playas. Most areas are oval and have smooth boundaries. Slopes are plane to concave and are commonly less than 0.3 percent. Areas generally range from 5 to over 100 acres. A few are larger. All receive runoff from adjoining areas. Most are wet for several weeks each year, and some are inundated for long periods.

Typically the surface layer is dark gray, moderately alkaline, calcareous clay about 22 inches thick. From 22 to about 66 inches is gray, moderately alkaline, calcareous clay that grades to grayish brown in the lower part.

Natural fertility of this Randall soil is high. Permeability is very slow. The available water capacity is high, but the soil is droughty. The hazard of soil blowing is moderate in dry areas that are bare of vegetation.

Included in some mapped areas are a few small tracts of Lipan and Lofton soils. The included soils make up less than 10 percent of any one mapped area.

The acreage is used entirely as rangeland. The production potential is high. The climax plant community is mainly a mixture of short grasses, mid grasses, and sedges. Controlled grazing and proper stocking are effective in preventing overuse.

The potential is very low for cropland or urban use because of the hazard of flooding. Major drainage and flood control are needed.

The capability subclass is VIw. The range site is Lakebed.

TAF—Tascosa association, hilly. This association occupies knolls, hills, and ridges that have rounded crests and moderately steep side slopes. A branching stream pattern intertwines between the hills and ridges. Slopes are convex and are 10 to about 30 percent. Areas are 20 to 500 acres.

The deep, well drained Tascosa soil is on the crests and upper sides of hills and ridges. Acuff, Likes, Mobeetie, Paloduro, and Veal soils are on the lower side slopes and foot slopes.

Tascosa and similar gravelly soils make up about 70 percent of this association. The other 30 percent is mainly Acuff, Likes, Mobeetie, Paloduro, and Veal soils. The composition of this unit is more variable than other map units in the county. Mapping has been controlled well enough, however, for the anticipated use.

Tascosa soil typically has a surface layer of dark grayish brown gravelly loam about 10 inches thick. From 10 to 18 inches is grayish brown very gravelly loam. To about 45 inches is very pale brown very gravelly sandy loam. The soil is moderately alkaline and calcareous and has masses and concretions of calcium carbonate throughout.

Natural fertility is low in the surface layer of this Tascosa soil. Permeability is moderate, and available water capacity is low. Surface runoff is rapid. The hazards of water erosion and soil blowing are slight.

This association is entirely rangeland. The production potential is moderate. The climax plant community is mainly a mixture of mid, tall, and short grasses and a few scattered shrubs. Proper stocking and controlled grazing are needed.

This association is not suited to farming and has low potential for urban uses. Slopes and small stones are limitations that are difficult to overcome. Gravel is mined in some areas for use in the construction industry.

The capability class is VIs. The range site is Gravelly.

Tf—Tivoli fine sand. This deep, excessively drained, gently sloping to strongly sloping soil is on hummocks and dunes that are 3 to 30 feet high. Slopes are 3 to 12 percent. Areas are oval and range from 50 to 600 acres.

Typically the surface layer is brown, neutral fine sand about 5 inches thick. From 5 to 60 inches is light brown, mildly alkaline fine sand.

Natural fertility is low. Permeability is rapid, and available water capacity is very low. Surface runoff is slow or

very slow. The hazard of water erosion is slight. The hazard of soil blowing is severe.

Included in mapping are small areas of Likes, Mobeetie, Potter, and Veal soils. Also included are a few small areas of active dunes and blown out spots. These areas make up less than 15 percent of any one mapped area.

This soil is not suited to crops. The entire acreage is used as rangeland. The production potential is medium. The climax plant community is a mixture of tall and mid grasses and scattered shrubs and trees. Proper stocking and controlled grazing are needed to prevent overuse and subsequent soil blowing.

The potential is high for most urban uses. Slope and sandy texture, the main limitations, can be overcome through proper planning, design, and installation.

The capability subclass is VIIe. The range site is Sand Hills.

TSD—Tivoli-Springer association, undulating. This association consists of deep, excessively drained and well drained, undulating and hummocky soils on upland plains. Slopes are dominantly about 2 percent but range from 1 to 8 percent. The Tivoli soil is on the crests and upper slopes of the hummocks. The Springer soil is on the lower slopes and intermound areas. Mapped areas of this association are irregularly shaped and range from 50 to 700 acres.

The excessively drained Tivoli soil makes up about 55 percent of this association, the well drained Springer soil 35 percent, and Amarillo soil 10 percent. Areas of these soils are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The surface layer of Tivoli soil is pale brown, neutral fine sand about 7 inches thick. From 7 to 60 inches is very pale brown, mildly alkaline fine sand.

Included in some mapped areas are small tracts of Amarillo fine sandy loam, blown out areas, and low dunes that have a billowy surface. These areas make up less than 10 percent of any one mapped area.

Natural fertility of this Tivoli soil is low. Permeability is rapid, and available water capacity is very low. Surface runoff is very slow. The hazard of water erosion is slight. The hazard of soil blowing is severe.

The Springer soil typically has a light brown, neutral loamy fine sand surface layer about 10 inches thick. The subsoil extends to a depth of 80 inches or more. To a depth of 42 inches is brown to light brown, neutral fine sandy loam. From 42 to 63 inches is brown, mildly alkaline loamy fine sand. From 63 to 80 inches is a reddish brown, mildly alkaline sandy clay loam.

Natural fertility of this Springer soil is low. Permeability is moderately rapid, and available water capacity is medium. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This association is not suited to crops. All the acreage is used as rangeland. The production potential is medium. The climax plant community is a mixture of tall and mid grasses and scattered shrubs, forbs, and short grasses. Careful management is needed to prevent overgrazing.

The potential is high for most urban uses. The slope and sandy texture, the only limitations, can be offset through proper planning and installation.

The capability subclass is VIIe for Tivoli soil and VIe for Springer soil. The range site is Sand Hills for Tivoli soil and Loamy Sand for Springer soil.

UB—Urban land. Urban land consists of downtown Amarillo, large suburban shopping centers, and parts of the Amarillo Municipal Airport. About 75 to 90 percent of this unit is covered with office buildings, hotels, railroad yards, multiple-unit dwellings, churches, schools, streets, sidewalks, parking lots, commercial buildings, runways, and industrial yards. About 10 or 15 percent is single-unit dwellings and their attendant works.

Installation of works and structures has so altered and obscured soil features that they do not resemble soils described in the various series. Small areas of undisturbed Pullman soil are in the downtown area.

Urban land is not assigned to a capability class or range site.

VPD—Veal-Paloduro association, undulating. This association consists of deep, well drained soils on low hills and ridges that have gently sloping to sloping side slopes. The hills and ridges are separated by narrow, branching draws. Slopes are convex and range from 3 to 8 percent. The Veal soil is on ridgetops and upper side slopes, and the Paloduro soil is on lower side slopes and foot slopes. Mapped areas are irregular in shape and range from 50 to 600 acres.

Veal and similar soils make up about 50 percent of this association, Paloduro and similar soils 40 percent, and Bippus, Potter, and Tascosa soils 10 percent. Areas are large enough to be mapped separately. Because use and management are similar, however, separation is not justified.

The surface layer of this Veal soil is brown, moderately alkaline, calcareous loam about 6 inches thick. From 6 to 14 inches is light brown clay loam. Below this to a depth of 60 inches is pinkish gray, calcareous clay loam that is about 45 percent calcium carbonate.

Natural fertility of this Veal soil is low. Permeability is moderate, and available water capacity is medium. Surface runoff is medium. The hazard of water erosion is severe in areas bare of vegetation. The hazard of soil blowing is moderate. The high lime content causes chlorosis in some plants.

The Paloduro soil typically has a dark brown, moderately alkaline, calcareous clay loam surface layer about 12 inches thick. From 12 to 80 inches is brown, moderately alkaline, calcareous clay loam that contains threads and films of calcium carbonate.

Natural fertility of this Paloduro soil is high. Permeability is moderate, and available water capacity is high.

Surface runoff is rapid. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

Rangeland is the main use of this association. The production potential is medium. The climax plant community is a mixture of mid and short grasses and scattered shrubs and forbs. Proper stocking and controlled grazing are needed.

This association is not suited to farming because of the slope and the hazard of erosion, and also because the Veal soil is high in lime content and is droughty.

The potential is high for most urban uses. Slope and low strength, the main limitations, can be overcome through proper design and construction.

The capability subclass is VIe. The range site is Loamy for Veal soil and Hardland Slopes for Paloduro soil.

VWF—Vernon-Owens association, rolling. This association consists of moderately deep and shallow, well drained soils on narrow ridges and side slopes along creeks and draws. Areas are irregularly shaped and range from 50 to 700 acres. They are dissected by numerous small drainageways that carry runoff swiftly into larger creeks. Slopes are dominantly 5 to 16 percent. Geologic erosion is active in these areas. The moderately deep Vernon soil is on ridgetops and foot slopes. The shallow Owens soil is on side slopes in steeper parts of this association.

About 45 percent of this association is Vernon soil, 30 percent Owens soil, and 25 percent mainly small areas of Clairemont, Quinlan, Tascosa, and Weymouth soils and some steep and moderately steep areas of Vernon and Owens soils. Mapped areas of this unit are large and the composition is variable. Mapping has been controlled well enough, however, for the anticipated use.

The Vernon soil typically has a reddish brown clay surface layer about 7 inches thick. From 7 to 38 inches is reddish brown clay that contains a few concretions of calcium carbonate. From 38 to 60 inches is red marine clay. This soil is moderately alkaline and calcareous throughout.

Natural fertility is medium in this Vernon soil. Permeability is very slow, and available water capacity is low. Surface runoff is rapid. The hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted because of the dense clayey texture.

The Owens soil typically has a reddish brown clay surface layer about 4 inches thick. The subsoil is about 9 inches of weak red clay. From 9 to 60 inches is weak red shaly clay that has a few reddish gray and strong brown mottles. The soil is moderately alkaline and calcareous throughout.

Natural fertility of this Owens soil is low. Permeability is very slow, and available water capacity is low. Surface runoff is rapid to very rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted because of the dense clayey texture of the underlying material.

All this association is used as rangeland. The production potential is low. The climax plant community is a sparse cover of short and mid grasses and a few scattered shrubs. Careful management is needed. Proper stocking and controlled grazing are needed to prevent overuse and subsequent erosion.

This association is not suitable for use as cropland because of the slope and the hazard of water erosion.

The potential for urban use is low. The shrink-swell potential, clayey texture, and low strength are limitations that are difficult to overcome.

The capability subclass is VIe. The range site is Shallow Clay.

WeB—Weymouth clay loam, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping soil is on ridges, knolls, and foot slopes below escarpments. Slopes are smooth and convex. Areas are irregular in shape and range from 15 to 400 acres.

Typically the surface layer is about 8 inches of reddish brown clay loam. From 8 to 14 inches is reddish brown clay loam that contains a few threads and films of calcium carbonate. From 14 to 40 inches is yellowish red clay loam that is about 20 percent calcium carbonate. Extending to a depth of 80 inches is a yellowish red partially weathered silty shale. This soil is moderately alkaline and calcareous throughout.

Natural fertility is medium. Permeability is moderate, and available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is easily penetrated.

Included in mapping are a few small areas of Aspermont, Owens, and Vernon soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is mainly rangeland. The production potential is medium. The climax plant community is short grasses and small amounts of mid grasses and forbs. Proper stocking and controlled grazing are needed to maintain productivity.

A few small areas of this soil are used for nonirrigated farming. The chief crop is winter wheat, but small amounts of grain sorghum are also grown. The potential is medium for crops. The limitations are slope and rooting depth. Good management is needed to control water erosion and soil blowing. Terraces, grassed waterways, and contour farming are needed to control excess rainfall. Managing crop residue on the surface and limiting tillage are effective in conserving moisture, slowing runoff, controlling soil blowing, and maintaining tilth.

The potential is medium for most urban uses. Low strength and the risk of corrosion, the main limitations, can be overcome through sound planning, design, and construction.

The capability class is IIIe. The range site is Clay Loam.

WeC—Weymouth clay loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on ridges and side slopes along natural drains. Slopes are smooth and convex. Areas are narrow and long and range from 15 to 200 acres.

This soil typically has a reddish brown clay loam surface layer about 9 inches thick. The subsoil from 9 to 38 inches is clay loam that is reddish brown in the upper part and yellowish red in the lower part. It is about 15 percent concretions and masses of calcium carbonate. From 38 to 80 inches is partially weathered shale. This soil is moderately alkaline and calcareous throughout.

Natural fertility is medium. Permeability is moderate, and available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is easily penetrated.

Included in some mapped areas are small tracts of Aspermont, Owens, and Vernon soils. These included soils make up less than 15 percent of any one mapped area.

The acreage is mostly rangeland. The production potential is medium. The climax plant community consists mainly of short grasses and a few scattered mid grasses and forbs. Proper stocking and controlled grazing are needed to maintain productivity.

A few small areas are used for nonirrigated winter wheat. Lesser amounts of grain sorghum are also grown. The potential is low for crops. The slope, rooting depth, and the hazard of water erosion are the main limitations. Careful management is needed to control water erosion and soil blowing. Terraces, waterways, and contour farming are needed to control excess runoff. Crop residue left on the surface and timely and limited tillage are effective in conserving soil moisture, slowing runoff, controlling soil blowing, and maintaining tilth.

The potential is medium for most urban uses. Low strength and the risk of corrosion, the main limitations, can be offset through sound planning and design and careful construction.

The capability subclass is IVe. The range site is Clay Loam.

WVD—Weymouth-Vernon association, undulating. This association consists of moderately deep, well drained soils that occur in a regular and repeating pattern. The landscape consists of knolls and ridges 10 to 60 feet high interspersed with smooth vales and draws. Slopes range from 1 to 8 percent. Geologic erosion is active in most areas. The gently sloping Weymouth soil occupies foot slopes and smooth vales and draws. The gently sloping to sloping Vernon soil is on ridgetops and side slopes. Areas are irregularly shaped and range from 50 to 500 acres.

About 40 percent of this association is Weymouth soil, 35 percent Vernon soil, and 25 percent Badlands and Bippus, Mangum, Paloduro, and Quinlan soils. Mapped areas of this unit are large and the composition is variable. Mapping has been controlled well enough, however, for the anticipated use.

The Weymouth soil typically has a surface layer of reddish brown clay loam about 7 inches thick. From 7 to 32 inches is yellowish red clay loam that is about 15 percent calcium carbonate. Below this is yellowish red, partially weathered silty clay loam shale. This soil is moderately alkaline and calcareous throughout.

Natural fertility of this Weymouth soil is medium. Permeability is moderate, and available water capacity is medium. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is easily penetrated.

The Vernon soil typically has a reddish brown, clay surface layer about 7 inches thick. From 7 to 38 inches is reddish brown clay that contains a few concretions of calcium carbonate. Below this is reddish brown clayey shale that has a few gray mottles. This soil is moderately alkaline and calcareous throughout.

Natural fertility of this Vernon soil is medium. Permeability is very slow, and available water capacity is low. Surface runoff is rapid. The hazard of water erosion is severe. The hazard of soil blowing is moderate. The root zone is restricted because of the dense clayey texture.

All this association is used as rangeland. The production potential is low. The Weymouth soil supports a plant community of short grasses mixed and a few mid grasses and forbs. The Vernon soil has a thin cover of mid and short grasses and a few scattered shrubs. Careful management of grazing is needed to prevent overuse.

This association is not suitable for use as cropland because of the slope.

The potential is low for urban use. The slope, low strength, clayey texture, and shrink-swell potential are limitations that are difficult to overcome.

The capability subclass is VIe. The range site is Clay Loam for Weymouth soil and Shallow Clay for Vernon soil.

Yo—Yomont soils, frequently flooded. This map unit consists of deep, well drained, nearly level soils on flood plains along major streams. It is subject to flooding one or two times each year. The floodwater is shallow and of short duration. It causes little damage to permanent vegetation. These soils are not uniform nor are they in a regular pattern. They have a variable surface soil texture of very fine sandy loam, silt loam, loam, or silty clay loam.

A typical area of this map unit is about 85 percent Yomont soils and about 15 percent Clairemont, Lincoln, and Mangum soils.

Typically the surface layer is reddish brown, very fine sandy loam about 16 inches thick. From 16 to 36 inches is reddish brown very fine sandy loam. From 36 to about 60 inches is reddish brown silty clay loam. This soil is moderately alkaline and calcareous throughout.

Natural fertility is moderate. Permeability is moderately rapid, and available water capacity is high. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. The root zone is deep and is easily penetrated.

This map unit is used entirely as rangeland. The production potential is high. The climax plant community is mid and tall grasses and a few scattered shrubs (fig. 9). Good management is needed to maintain productivity.

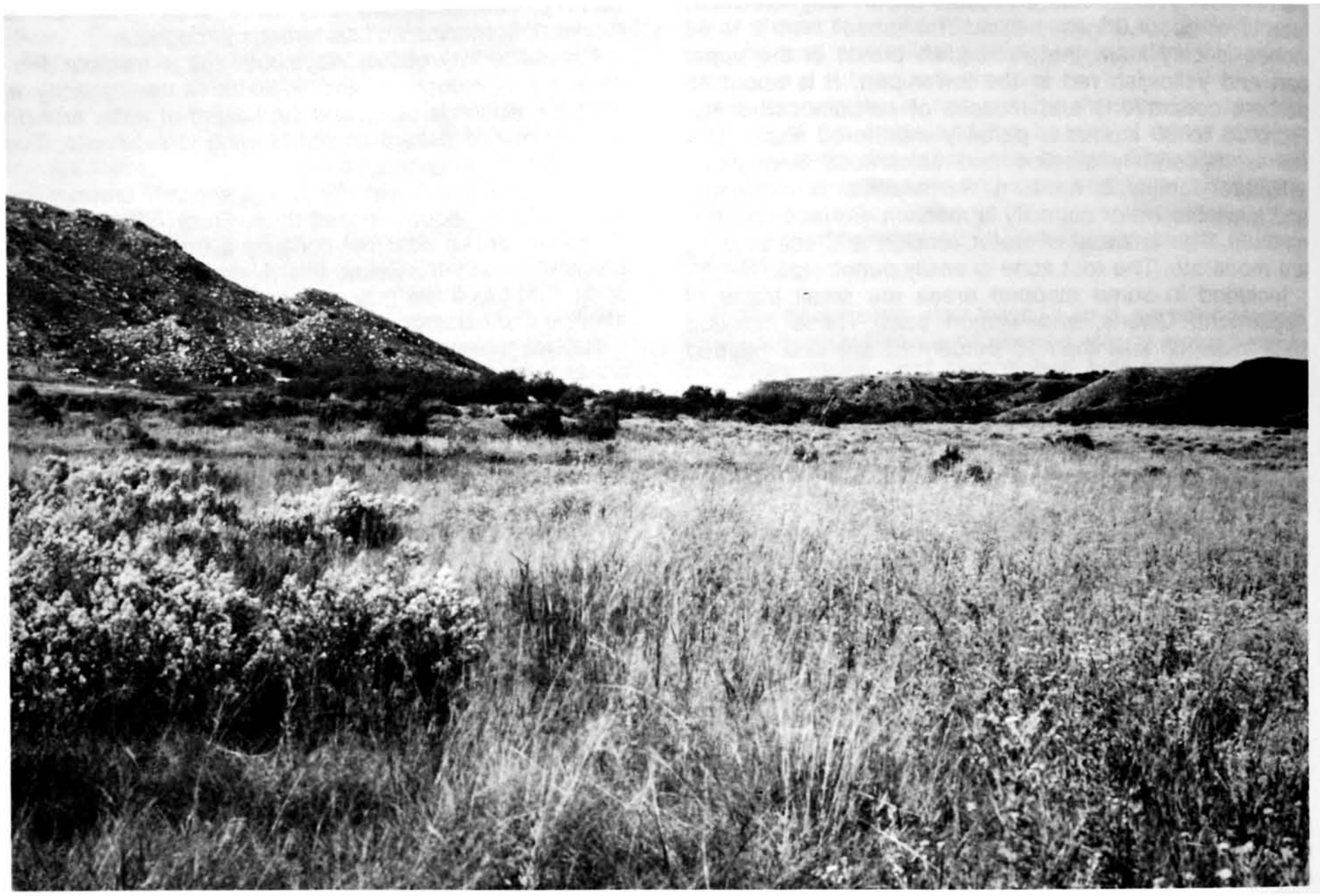


Figure 9.—Area of Yomont soils, frequently flooded.

These soils are not suitable as cropland or for urban use because of the hazard of flooding.

The capability subclass is Vw. The range site is Loamy Bottomland.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to

identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

Allen H. King, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 59,000 acres in the survey area was used for crops in 1970, according to the Conservation Needs Inventory (*5*). Of this total, 18,000 acres was irrigated grain sorghum and winter wheat, and 35,000 acres dryland wheat and grain sorghum. The rest was idle.

The soils in Potter County have good potential for increased production of food and feed grains. Crop production on dryfarmed and irrigated land could be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

Acreage in crops has remained constant. The irrigated acreage, however, is slowly decreasing because the water table is lowering, or declining, and more farmland is under urban development. It is estimated that about 700 acres of farmland is taken out of production annually and used for urban development. The use of this soil survey in making land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map for broad land use planning."

Climate is the factor that most affects farming in Potter County. Annual rainfall is low, and the growing season short. About two-thirds of the total precipitation is lost through evaporation. Conserving moisture is essential for dependable production on all cropland. Windstorms, occasional rain of high intensity, hail, drifting snow, and prolonged severe drought are hazards that must be considered in management.

In planning effective management, a farmer must know what conservation practices are suited to the soil and the climate, how much the soil can produce, and what kinds of limitations can be expected.

Erosion

Erosion caused by runoff is a major problem on all cultivated soils having slopes of more than 1 percent. As the length and gradient of slope increases, the hazard of erosion increases.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Pullman (fig. 10), and to soils that have a large accumulation of calcium carbonate in the upper part of the subsoil, for example, Estacado and Posey soils. Erosion also reduces productivity on soils that tend to be droughty, such as Lipan, Lofton, and Mangum soils. Second, soil erosion on farmland results in sedimentation of streams and reservoirs. Control of erosion minimizes the pollution of streams and lakes by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control provides protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soil.

Winter wheat and sorghum are the crops best suited to the climatic conditions of the county. Wheat, the major crop in such a system, should be grown in years when stored moisture and crop residue are adequate for erosion control. If the amount of soil moisture and crop residue is unfavorable for wheat production, sorghum crops that resist erosion can be substituted. Essentially the same cropping system can be irrigated or dryfarmed. A better soil improvement program, however, can be carried out under irrigation. Commercial fertilizer can be added, more crops can be grown for green manure, more crop residue can be produced, and better use can be made of the residue.

Terraces, diversions, and contour farming shorten the length of slope and reduce runoff and the risk of erosion. They are most practical on deep, well drained soils that have smooth slopes of 1 to 5 percent. On the nearly level Acuff, Olton, and Pullman soils, terracing and contour farming are used mainly to conserve moisture. All terraces require suitable outlets to dispose of excess water. If natural grassed drainageways are not available as outlets, grassed waterways should be constructed before terraces are built.

Minimum tillage (fig. 11) is needed. Excessive tillage tends to break down the structure of the soil. It produces a powdery surface layer that is highly susceptible to blowing. It does not absorb water readily, and it tends to crust following rains. Minimizing tillage and leaving crop residue on the surface increase infiltration, reduce evaporation of soil moisture, and slow runoff. These practices

Figure 10.—Water erosion on Pullman clay loam, 1 to 3 percent slopes.

can be adapted to Acuff, Estacado, Lofton, Olton, and Pullman soils. They are more difficult to practice successfully, however, on soils that have a clayey surface layer, such as Lipan and Mangum.

Soil blowing is a hazard on the loamy Amarillo and Mobeetie soils, the calcareous Estacado and Posey soils, and the sandy Likes, Springer, and Tivoli soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, surface mulch, or rough surface through proper tillage minimizes the hazard of soil blowing. Emergency tillage may be needed during a prolonged drought when vegetation is inadequate to protect the soil from blowing. Chiseling or listing makes the surface cloddy or rough so that the impact of the wind is broken and drifting soil is trapped. Emergency tillage has only a temporary effect. It may have to be repeated during the blowing season. Windbreaks of adapted shrubs and trees, such as Siberian elm or eastern redcedar, are effective in reducing soil blowing around homes and gardens.

Information on the design and application of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Irrigation

Irrigation supplements deficient rainfall on about 18,000 acres of the deep, nearly level, fertile Acuff, Estacado, Lofton, Olton, and Pullman soils.

Fertility

Soil fertility is naturally high in the Acuff, Bippus, Estacado, Lofton, Olton, Paloduro, and Pullman soils. These

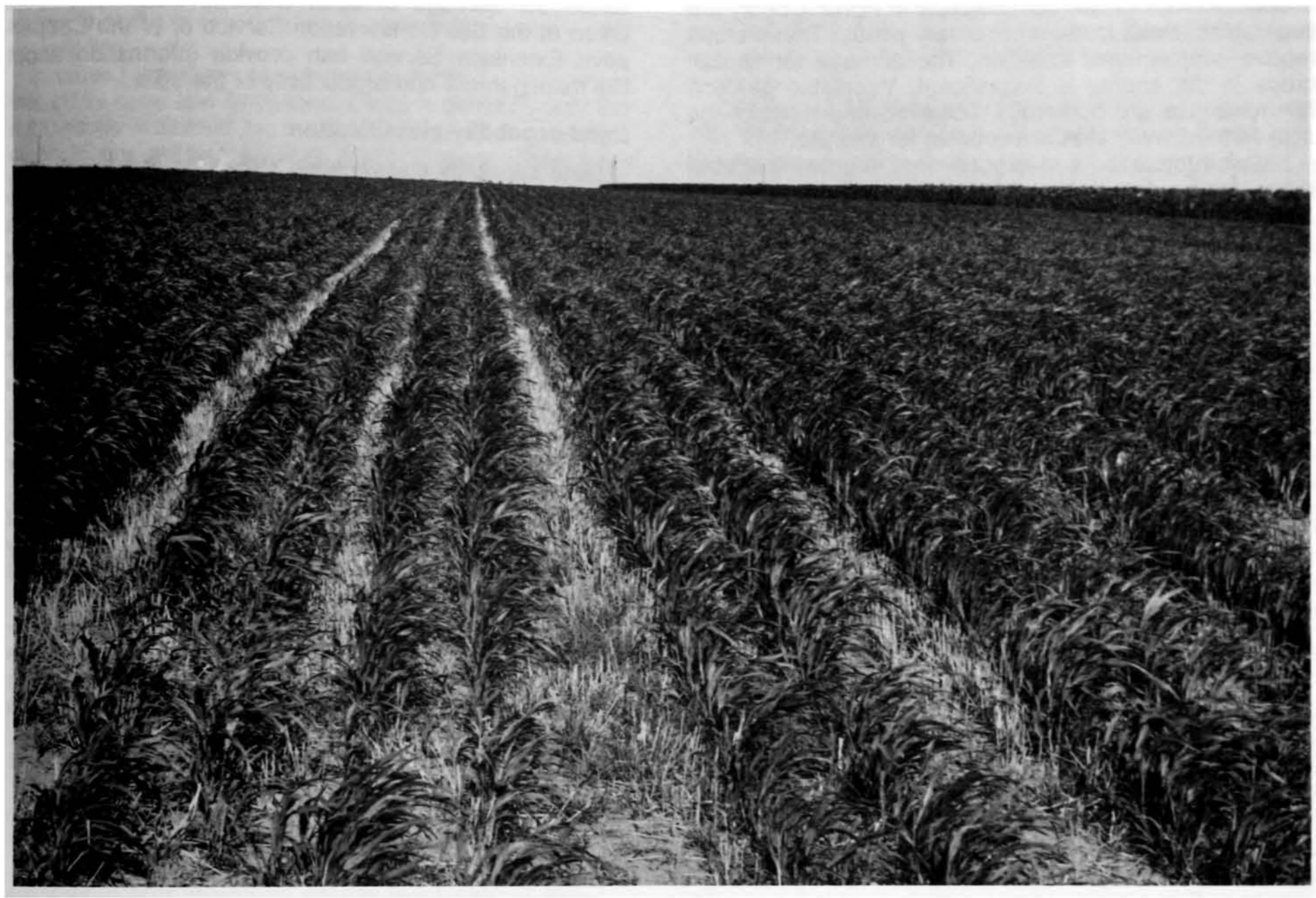


Figure 11.—Minimum tillage on sorghum following wheat. The soil is Pullman clay loam, 0 to 1 percent slopes.

soils range from neutral to moderately alkaline. Bippus, Estacado, and Paloduro soils are calcareous. Additions of trace elements, such as iron, may be needed to overcome the effects of chlorosis caused by the high lime content in the Estacado and Posey soils.

Experimental records show that dryfarmed crops on clayey and loamy soils do not generally respond to commercial fertilizer. Fertilizer has proven profitable and advantageous, however, on irrigated soils.

The addition of fertilizer and trace elements to any soil should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer and lime to be applied.

Tilth

Tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are generally friable, granular, and porous.

Most of the soils used for crops in Potter County have a dark colored loam or clay loam surface layer. The content of organic matter is moderate to high. Generally the structure of such soils is moderate. The regular addition of crop residue, manure, and other organic material can help maintain or improve soil structure and tilth.

Crops

Field crops suited to the soils and climate of Potter County include many that are not now commonly grown. Corn and grain sorghum are the chief row crops. Soybeans, sunflowers, sugar beets, and similar crops can be grown under irrigation if economic conditions are favorable.

Winter wheat is the principal close-growing crop. Rye and spring seeded oats are other small grains that are sometimes grown for grazing or as green manure crops.

Special crops grown commercially in Potter County are vegetables, small fruits, and nursery plants. These crops require supplemental irrigation. The acreage for special crops in the county is insignificant. Vegetable gardens for home use are numerous, however, and most of the soils in the survey area are suitable for this use.

Latest information and suggestions on growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

In general, the soils in the survey area that are well suited to crops are also well suited to urban development. Data on specific soils in this survey can be used in planning future land use patterns. Potential productive capacity in farming should be weighed against soil limitations and potential for nonfarm development.

In some areas are soils that are well suited to farming but poorly suited to nonfarm development, for example, map unit 2 on the general soil map at the back of this publication. In this area the dominant soil is Pullman clay loam, which has a high shrink-swell potential and low strength. Both are serious limitations for nonfarm development. This Pullman soil, however, is productive for farm crops.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony;

and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

Rangeland

John A. Wright, range conservationist, Soil Conservation Service, helped prepare this section.

On many ranches the forage produced on rangeland is supplemented by crop stubble and small grain (fig. 12). In winter the native forage is often supplemented by the addition of protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush, weeds, and cactus. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by using management practices that are effective for specific kinds of soil and range sites.

Ranching and livestock production are the most important agricultural enterprises in the county. Native grassland covers about 428,000 acres, or 75 percent of Potter County. More than three-fourths of the agricultural income is derived from livestock, principally cattle. Most of the rangeland is in the Canadian Breaks, which is the northern 85 percent of the county. There are less than 20 ranch units. They range from 5,000 to 50,000 acres, averaging about 25,000 acres.

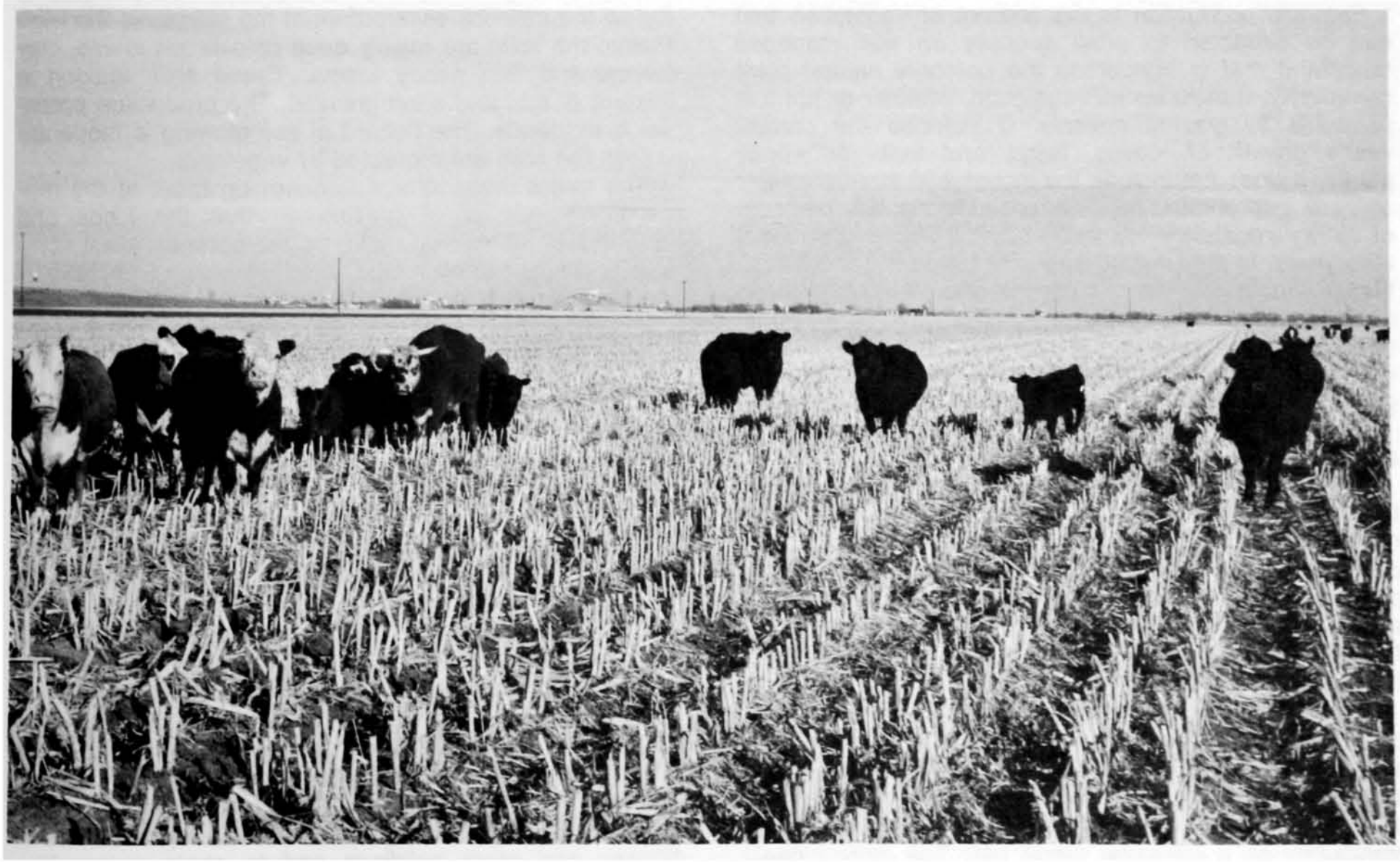


Figure 12.—Grain sorghum stubble supplements native range. The soil is Pullman clay loam, 0 to 1 percent slopes.

Most ranches are cow-calf operations, though stocker steers make up a significant percentage of many herds. Usually these stocker cattle are placed in nearby feedlots for finishing.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 5 shows, for each soil in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Explanation of the column headings in table 5 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, calcium carbonate content, and a seasonal high water table are also important.

Potential production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Common plant name—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the extreme southern part of the county, a nearly level tableland called the High Plains, the soils are deep noncalcareous loams and clay loams. These soils support a mixture of short and mid grasses. The production potential is medium. Near the caprock escarpment and the rougher areas along the Canadian River the soils are dominantly very shallow and gravelly. They support a thin cover of mid and short grasses. The production potential is low because the root zone is shallow. Along and on either side of the river are several areas of deep sandy soils that support a dense cover of tall and mid grasses. The production potential is high, but the hazard of soil blowing is severe if the plant cover is overgrazed. Below the caprock escarpment at the margin of the High Plains, the soils are mainly deep calcareous loams, clay loams, and fine sandy loams. These soils support a mixture of mid and short grasses. The production potential is moderate. The hazard of soil blowing is moderate unless the soils are protected by vegetation.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are re-established. Controlling brush and minimizing soil blowing are also important management concerns. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of range in the area.

Windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely

spaced (fig. 13). To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 6 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 6 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil proper-

Figure 13.—Farmstead windbreak on Pullman clay loam, 0 to 1 percent slopes.

ties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants (fig. 14).

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce

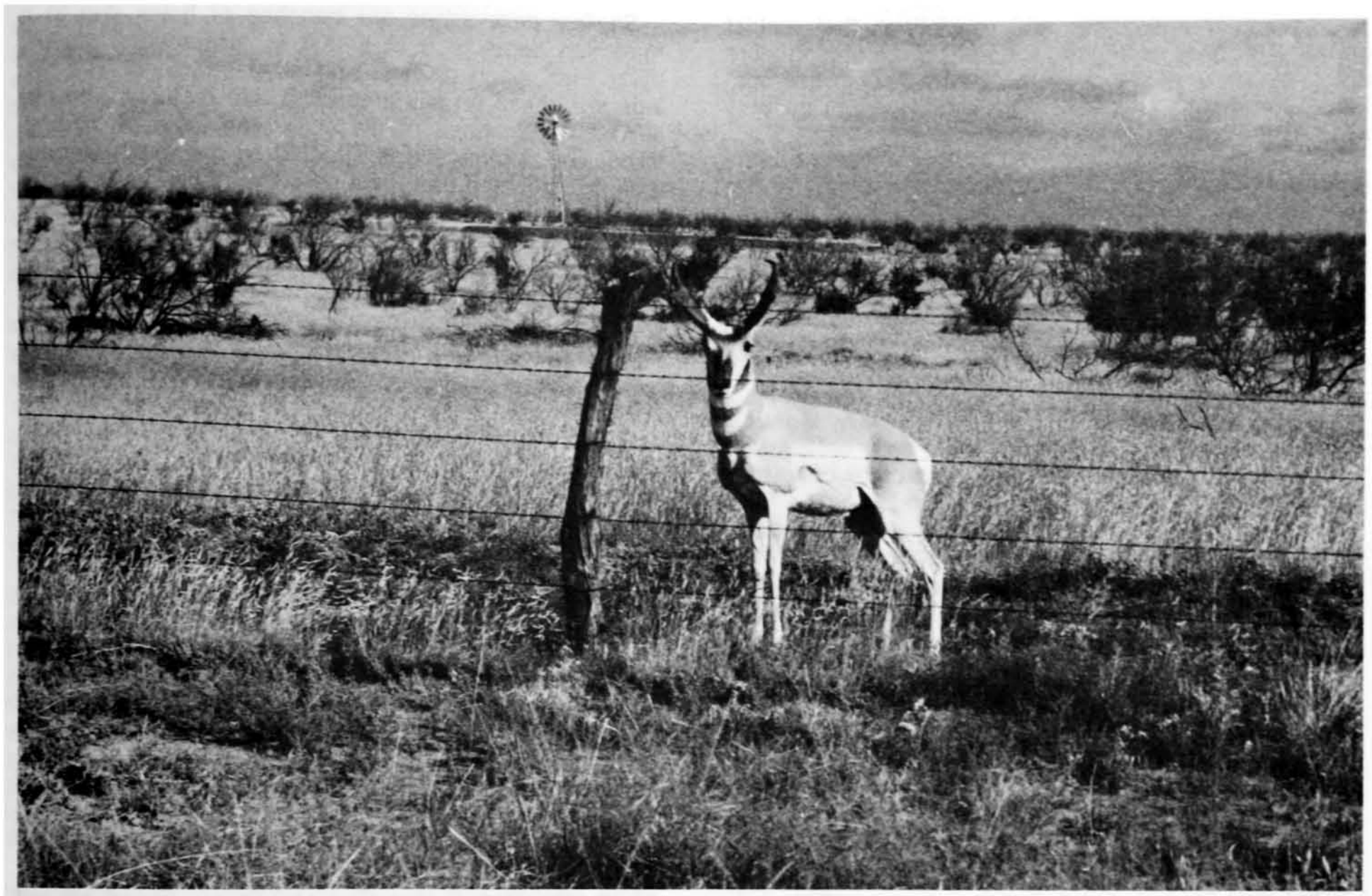


Figure 14.—Antelope common to the open prairie. The soil is Weymouth clay loam, 1 to 3 percent slopes.

grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include pronghorn antelope, deer, sage grouse, meadowlark, and lark bunting.

Engineering

Dan C. Huckabee, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that

soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, topsoil, sand, and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low

embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5

feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Town and country planning

Expansion of residential subdivision in Potter County and the accompanying extension of public utilities create a need for soil information that differs somewhat from the information needed for purposes of agriculture. Information is needed for individual residential tracts that are inaccessible to public utilities, especially for example, summer homes and recreation facilities.

Land appraisers, realtors, city planners, builders, and individuals need to know what sites are suitable for homes or other buildings and what areas should be reserved for other uses. Most soil properties that are important in town and country planning are also important in engineering. See "Engineering" and "Engineering index properties" for explanations of soil interpretations. The information in the engineering sections does not eliminate the need for more detailed onsite study if soils are to be used for intensive purposes. Some lots include areas of contrasting soils that are too small to be mapped separately.

This section briefly discusses the importance of site selection, potential foundation problems, considerations for sewage disposal systems, corrosion problems of underground utility lines, and control of erosion and runoff. Discussed also are the use of soils for gardening and landscaping and the influence of soils on public health.

Site selection

In selecting a site for the construction of urban works and structures, the soil should be carefully investigated. Planners, builders, and maintenance men have met costly failures that can be traced to mistakes made in selecting soils for proposed structures or lack of information about the soils that were selected. If the soil is poorly suited to the intended use, little can be done to change it without great expense. Structural design can overcome some soil limitations, but the problem must be known before construction.

One of the first considerations is the flood hazard. The alluvial Bippus, Clairemont, Mangum, and Spur soils, all of which are subject to occasional or frequent flooding, should not be considered as sites for permanent structures. Areas of these soils can be reserved for greenbelts, sound barriers, wildlife habitat, and recreation uses, such as hike and bike trails or picnic areas. Randall soils are not alluvial, but they are subject to inundation from runoff, and therefore should not be used for urban works and structures.

Site selection is also affected by permeability, available water capacity, drainage, soil reaction (pH), shrink-swell potential, risk of corrosion to steel and concrete, hydrologic classification, suitability as a septic tank absorption field, suitability as a site for foundation and low cost streets and roads, runoff problems, and the hazard of erosion, potential for recreation areas, influence of the soil on the overall general health of residents, and suitability for grasses, flowers, vines, shrubs, and trees. Many of these properties, features, and interpretations are given under "Engineering" and "Recreation." Some are discussed in the following paragraphs.

Foundations

Clay soils in the playa basins of Potter County are high in the clay mineral montmorillonite. They swell when wet and shrink and crack when dry. This change in volume as the moisture content changes in a soil material is called the shrink-swell potential (see table 16). The action creates such pressure that walls and foundations crack unless they are reinforced. Sometimes, they crack

even if special reinforcement is used. Damage occurs most often on the Lipan and Randall soils. In Lofton and Pullman soils the lower layers have a high content of montmorillonitic clay.

Soils likely to shrink and swell enough to damage foundations are those that have a high liquid limit and high plasticity index, or those soils classified as CH in the Unified System of Classification. See table 15 for estimated engineering properties and classification. See also table 9, where soils are rated according to their suitability for building site development.

Also to be considered is the damage to foundations on soils that are flooded, ponded, poorly drained, or wet or have low strength or a high corrosion potential.

Sewage disposal systems

Each year many houses are built beyond existing municipal sewerlines where an onsite sewage disposal system is needed. The effectiveness of such a system depends largely on the absorptive capacity, permeability, percolation rate, and wetness of the soil; the hazard of flooding and seepage; and the slope of soils within the filter field (*9*).

Soils of the High Plains in Potter County generally are severely limited as sites for septic tank absorption fields. They are loamy and have a very slowly permeable clayey subsoil. The clayey soils of playa basins are poorly drained and are wet for 1 to 4 months each year.

In table 10, the soils are rated for sanitary facilities. By identifying the soils on the soil map and then referring to the ratings in table 10, it is possible to get a general idea of how well a septic tank system can function in a selected area. Nevertheless, it is advisable to make a detailed inspection of the soils at the exact site that is to be used as a filter field.

Underground utility lines

Water mains, gas pipelines, communication lines, and sewer pipes that are buried in the soil may corrode and break unless protected against certain electrobiochemical reactions resulting from the inherent properties of the soil.

All metals buried in the soil corrode to some degree. Some metals corrode more rapidly in some soils than in others. The corrosion potential depends on the physical, chemical, electrical, and biological characteristics of the soil. It is influenced by concentrations of oxygen or anaerobic bacteria, moisture content, and external factors, such as manmade electrical currents. It is also influenced by design and construction. Occasionally, the risk of corrosion is intensified by connecting two dissimilar metals, by burying metal structures at varying depths, and by extending pipelines through different kinds of soils. Table 16 gives the estimated risk of corrosion in the soils of Potter County.

In soils that have a high shrink-swell potential, the stress created by volume changes can break cast iron pipe. To prevent breakage, it may be necessary to cushion the pipes with sand. Table 16 gives the estimated shrink-swell potential of the soils in Potter County.

Control of erosion and runoff

During urban construction the natural vegetation is generally removed and large areas are covered with pavement, concrete, and buildings. The amount of runoff from construction areas generally increases, and the pattern of runoff changes. Runoff after a heavy rain may be several times as great as when the same land was used for farming. The runoff concentrates in streets and gutters, instead of flowing into natural waterways, and the result is flooding, erosion, and deposition of sediment in lower lying areas. See table 12 for limitations and features affecting water management.

The control of erosion and runoff should begin at the planning and designing stage, before plans become fixed and construction begins. With a good development plan, the problems brought on by soil erosion, runoff, and sedimentation can usually be avoided or lessened (*7*).

There are two kinds of erosion and sediment control measures—mechanical and vegetative.

Mechanical measures that reshape the land and intercept, divert, or convey runoff or retard or otherwise control erosion, are—

1. *Land grading.*—Grading only those areas under immediate construction, as opposed to grading the entire site. Large areas can be protected by vegetation until construction begins.
2. *Bench terraces.*—Constructing bench terraces across the slope to conform with the natural terrain. This type of construction breaks long slopes and slows the flow of runoff.
3. *Diversions.*—Constructing a channel and a ridge across the slope for intercepting and diverting runoff. A stable outlet is needed to dispose of the water safely.
4. *Berms.*—Compacting earth in ridges on a slight grade and having no channels. Berms are a type of diversion. They may be temporary or permanent.
5. *Storm sewers.*—Constructing a channel, usually underground, to dispose of runoff from streets and adjacent lots. To prevent sediment from being deposited downstream or even clogging the storm sewers, small sediment basins can be temporarily or permanently constructed adjacent to sewer inlets.
6. *Outlets.*—Constructing grassed waterways or other types of outlets to dispose of water safely from diversions, parking lots, streets, and other areas.
7. *Waterway stabilization structures.*—Combining grade stabilization structures, special culverts, and different kinds of pipe with vegetation to prevent erosion on slopes too steep for vegetative protection alone.
8. *Lined channels.*—Using plastic or fiberglass mats as temporary lining for ditches and channels. This

measure is used where slopes are too steep or soils too unstable for control by vegetation alone.

9. *Sediment basins.*—Constructing temporary earth dams across waterways to serve as sediment basins. This measure detains runoff and traps sediment, preventing damage to areas downstream.

Vegetative measures that control erosion and runoff during and after construction are—

1. *Mulches.*—Small grain, straw, hay, and certain processed materials can be used to protect slopes and other critical areas brought to final grade at an unfavorable time for seeding. The areas can be seeded at the proper time without removing the mulch. Mulches should be anchored with asphalt, straight blade disks, netting, or other methods. Hydromulching, in which seed, fertilizer, and mulch are applied as a slurry, is a fast all-in-one operation that requires little labor.
2. *Temporary cover.*—Rapidly growing plants, such as annual ryegrass and small grain, can be used where cover is needed for a few months or for 1 or 2 years.
3. *Permanent cover.*—Bermudagrass, bluegrass, fescue grass, adapted legumes, trees, shrubs, and certain vines make good permanent ground cover. Most grasses and legumes require maintenance, such as weeding, fertilizing, and mowing.
4. *Fibrous materials.*—Jute netting, cotton netting, paper netting, and fiberglass matting have special uses in controlling erosion and runoff. Most of these fibrous materials are used only temporarily to hold mulches in place or prevent soil from blowing or washing while plant seedlings are established.

In many areas the overall development plan does not include the control of erosion and runoff. Erosion-control measures are left up to the individual homeowners. Some measures that are practical in protecting small residential tracts are—

1. *Grading.*—Grading the surface of the lot to make it level or gently sloping. In areas where soils have a loamy surface layer, it is beneficial to remove and stockpile the topsoil and replace it on the graded surface.
2. *Contouring.*—Locating driveways, walks, fences, retaining walls, and raised flowerbeds on the contour or straight across the slope.
3. *Diversions.*—Constructing small channels to intercept runoff, preventing it from flowing across erodible areas. Diversions should be protected with permanent vegetation.
4. *Waterways.*—Constructing waterways to prevent gullying and to drain areas where water stands. Waterways should be shaped, smoothed, and established with sod. In some cases, waterways may be small ditches along property lines between lots. They generally empty into bar ditches or paved and curbed streets.
5. *Drainage.*—Constructing ditches or tile drains to drain seep spots, waterlogged areas, and small ponded areas. Some low areas may be filled with good topsoil.

Special care should be taken in planning and applying erosion-control and runoff-control measures. These measures should be designed to fit in well with the esthetic surrounding of the homesite.

Potential for urbanization

The potential of a soil is its ability to produce, yield, or support a given structure or activity at a cost expressed in economic, social, or environmental units of value.

The soils of Potter County have been rated in table 13 according to their potential for urbanization. Among the elements considered are (1) dwellings without basements, but with public sewer systems, (2) streets, (3) excavations in which to place utilities, and (4) uncoated steel pipe. Also considered were shopping centers and small businesses.

The soils that have the highest potential for urbanization are those on which streets and structural foundations can be placed without deteriorating because of adverse soil properties. In general, these same soils are easy to dig in, easy to grow plants in, and present a well drained, nonflood landscape that is pleasing to the eye.

The factors to be considered in rating the potential of a soil for each element of urbanization are (1) flooding, (2) slope, (3) depth to rock, (4) shrink-swell potential, (5) soil strength, (6) soil texture, (7) risk of corrosion to uncoated steel, and (8) stoniness.

Soils subject to flooding have a very low potential for urbanization because of the difficulty and expense involved in controlling flood waters. Generally the watershed is an area much larger than any single land developer controls.

The potential for urbanization is medium for soils that have a high shrink-swell potential or low strength. These factors can be partially overcome by increasing the strength of the structures. In Potter County, additional factors such as clay texture and high risk of corrosion to uncoated steel further lower the potential for urbanization.

Clay soils and loamy soils that have a clayey subsoil are difficult to excavate and move or manipulate. This adds additional cost to development and maintenance.

Soils that are highly corrosive to uncoated steel pipe generally have other factors that lower their potential. The corrosive effect on uncoated pipe can be partly overcome by using protective coatings, by attaching anodes to the metal, or by using more resistant metals or materials such as plastics or concrete.

In table 9, the limitation of a soil for building site development can be based on the rating of a single

factor. For example, a soil having a high shrink-swell potential is rated as having a severe limitation because of a single factor. In table 13, "Potential for urbanization," the rating factors are cumulative. A wet soil that shrinks and swells greatly and is highly corrosive to metals is rated lower than a soil that is only wet. The rating of elements for urbanization, that is, dwellings, streets, excavations, and uncoated steel pipe, is also cumulative in arriving at the overall potential of the soil for urbanization.

The potential of soils for urbanization is divided into five classes—High, medium, low, very low, and unsuited. The potential is *high* if very few factors are likely to cause problems during construction or after development. The factors can be easily and economically corrected.

It is *medium* if only a few factors cause problems during construction or after development. The factors can be economically overcome.

The potential is *low* if several factors cause problems during construction or after development. Some factors can be easily overcome, but one or more factors will be difficult or expensive to overcome.

It is *very low* if several factors cause problems, both during construction and after development. Factors can be overcome only with difficulty and very expensive measures.

Gardening and landscaping

Allen H. King, conservation agronomist, Soil Conservation Service, helped prepare this section.

Surburban homeowners who want to landscape their homes need to know what kinds of soils their properties include and what kinds of flowers, ground cover, vines, shrubs, and trees are best suited. In some areas plants are needed for erosion control as well as esthetic purposes.

Soils well suited to yard and garden plants are those that have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter in various stages of decomposition, an adequate water supplying capacity, good drainage, and a granular structure that allows free movement of water, air, and roots.

The degree of acidity or alkalinity suitable for the particular plant is also important. For example, roses and most annual flowers, vegetables, and grasses grow best in soils that are neutral (noncalcareous) or only slightly acid. Azaleas and similar plants need acid soils. Some plants grown on soils high in lime content, such as Estacado or Posey soils, develop a condition called chlorosis, or yellowing of the leaves. Many flowers, shrubs, and trees, however, are well suited to the limy (calcareous) soils in Potter County. Some of these flowers are shasta daisies, hollyhocks, petunias, and zinnias. Honeylocust, elm, Arizona cypress, and fruitless mulberry are some of the adapted trees. Shrubs include various forms of juniper, nandina, lilac, and bridalwreath.

Table 14 lists some of the flowers and ground cover, vines, shrubs, and trees suitable for the soils in Potter County. Some of these plants are native to the area. For lists of additional plants suitable for Potter County soils, consult your local nurseryman or the county extension horticulturist.

Column 1 in table 14 lists the soil names and map symbols.

Column 2 lists the more common flowers and ground cover plants adapted to each soil. The remaining three columns list the most common adapted vines, shrubs, and trees for each soil.

See soil descriptions, which begin on page 8, for information on soil texture, drainage, permeability, structure, and other characteristics. Table 15 shows soil reaction (pH), permeability, and available water capacity of the soils.

Conditioning the native soil is generally cheaper and more advisable than replacing it with manmade soil material. The soil should be tested and fertility needs determined for the plants to be grown. The most important amendment to the soil is organic material—manure, cotton burs, peat moss, compost, rotted sawdust, grass clippings, or tree leaves. At least 2 inches of organic material should be added. In addition, for clayey soils, at least 2 inches of sand, perlite, or vermiculite is needed. The addition of trace minerals such as iron is frequently needed on limy soils. All of these materials should be spaded or rototilled into the top 8 inches of the native soil. If an acid soil is desired, a local nurseryman or horticulturist can provide information on the quantity and kinds of chemicals needed.

The Randall soils in Potter County are so clayey and so poorly drained that it may be necessary to construct raised beds in order to grow flowers and some shrubs. Brick, tile, metal, cedar, or redwood makes a good retainer along the edge of beds. Beds should be filled with good soil material and well balanced physical and chemical amendments.

All plants in native soil or manmade soil require careful maintenance, especially during the period of establishment. Good management includes fertilizing, watering, and controlling weeds and insects. In addition protective measures against high winds, hail, blowing soil, and extremes in temperature should be considered during establishment periods of all plants.

Gardening and landscaping should be included in the basic planning of urban construction. The potential of the native soil for growing plants should be considered in selecting sites for urban construction. Also important is the protection of existing trees and shrubs during construction. Many potential landscape trees are killed or damaged beyond restoration because construction crews, supervisors, or property owners are careless in excavation, fill, and construction activities. For guidelines on the protection of existing trees and shrubs, consult the Soil Conservation Service or the Agricultural Extension Service.

Public health

Using soils for sewage disposal and sanitary landfill, locating potential sites of disease carrying insects, and providing adequate shelter all affect public health.

Sewage disposal.—Sewerlines, septic tank systems, and sewage lagoons should be located and constructed so that seepage or drainage cannot pollute the water supply. Stability of the soil is important in locating sewerlines. If the gradeline is interrupted, the sewerage system breaks down and a public health hazard results. Tables 13 and 16 provide information on the shrink-swell potential, the risk of corrosion, and the volumetric shrinkage that can be of value in locating pipelines and protecting pipelines against corrosion and breakage. Water wells, streams, and lakes can become contaminated by runoff from clogged filter fields, and rapid percolation of septic tank effluent can result in pollution of underground water. Seepage from sewage lagoons built on unsuitable soil material is another cause of pollution. Table 10 rates the soils of Potter County as sites for septic tank absorption fields and sewage lagoons.

Sanitary landfill.—In selecting sites for sanitary landfill, it is necessary to consider the topography and drainage of the area and the characteristics of the soils, which include texture, permeability, reaction, and nature of the underlying material. See table 10. Selecting sites for sanitary landfill requires onsite inspection. Excavations for sanitary landfill are generally more than 6 feet deep, and soil maps may contain small areas of soils that have strongly contrasting properties.

Disease carrying insects.—Mosquitoes, fleas, and other disease carrying insects breed in stagnant water. By using the soil map and soil descriptions, it is possible to identify areas subject to flooding and areas likely to be ponded from time to time because of nearly level topography or poor internal drainage. Once these possible trouble spots are located, the health hazard can be controlled by spraying to eliminate insects and installing drainage systems to remove the standing water that attracts insects.

Shelter.—Adequate housing is important. No houses should be built where there is danger of flooding or of ponding of surface runoff. Floodwater causes the failure of sewage systems and attracts disease carrying insects. Some soils in Potter County shrink and swell enough to crack foundations and walls. A health hazard results because rainwater seeps in through the cracks and insects collect in the moist spots. A study of the soil map and the soil descriptions can help planners avoid such difficulties.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 15.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and

maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 15.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class,

total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost.

Soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field

or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*8*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Acuff series

The Acuff series consists of deep, dark brown, well drained soils that formed in loamy eolian deposits. These soils occur throughout the county (fig. 15). Slopes are plane to convex. They range from 0 to 5 percent but are dominantly 0.3 to 4 percent.

Typical pedon of Acuff loam, 1 to 3 percent slopes. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 25 miles north on U.S. Highway 287, 0.5 mile northeast on private road, 100 feet south of road in area of rangeland:

A1—0 to 11 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium granular structure; hard, friable; many fine roots; many fine pores; few worm casts; neutral; gradual smooth boundary.

B21t—11 to 17 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; common fine roots; common fine pores; few worm casts; few clay films on peds; neutral; gradual smooth boundary.

B22t—17 to 30 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine roots; common fine pores; few worm casts; few clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23t—30 to 52 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine roots; few fine pores; few clay films; few worm casts; many threads and films and few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

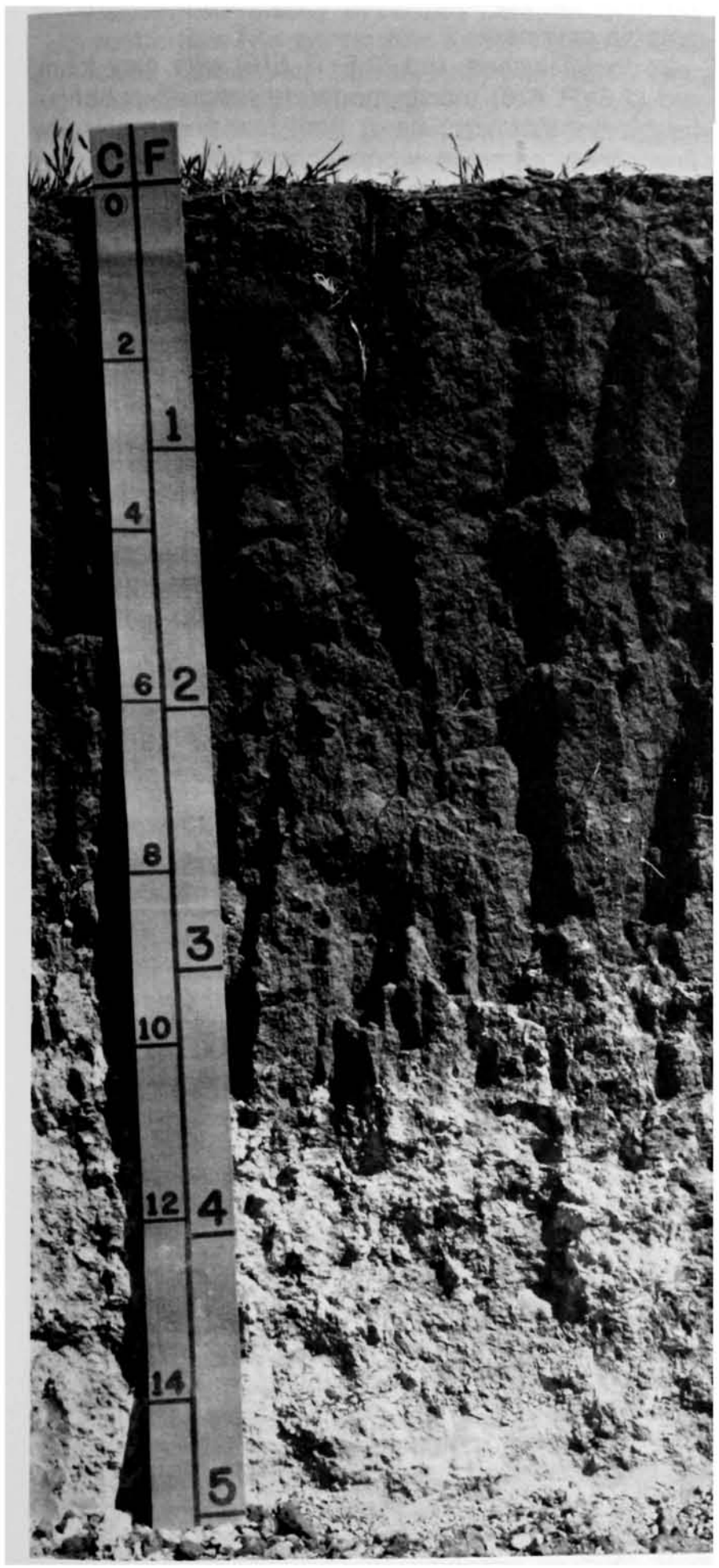


Figure 15.—Profile of Acuff loam, 1 to 3 percent slopes.

B24tca—52 to 65 inches; pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; about 40 percent by volume calcium carbonate, 30 percent of which is concretions 2 to 10 mm in diameter; calcareous; moderately alkaline; gradual smooth boundary.

B25t—65 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few fine pores; few clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to more than 100 inches. Depth to visible forms of calcium carbonate is 15 to 28 inches. Depth to a calcic horizon is between 30 and 60 inches.

The A horizon is brown, dark brown, or reddish brown. It is neutral to mildly alkaline. Texture is loam or sandy clay loam.

The B2t horizons above the calcic horizon are dark brown, brown, reddish brown, reddish yellow, or yellowish red. Texture is clay loam or sandy clay loam. Reaction is neutral to moderately alkaline. The Btca horizon is pink or light brown. It is 20 to 60 percent by volume calcium carbonate. The lower part of the B2t horizon is red, reddish yellow, or yellowish red. It is about 3 to 20 percent by volume calcium carbonate in the form of threads, films, and concretions.

Amarillo series

The Amarillo series consists of deep, brown, well drained soils that formed in loamy eolian deposits. These soils occur throughout most of the county. The slope ranges from 1 to 5 percent.

Typical pedon of Amarillo fine sandy loam, 1 to 3 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1719 in Amarillo, about 4.0 miles north on Farm Road 1719 to its intersection with paved county road, 1.0 mile north on county road, 8.1 miles northwest on paved county road, 6.2 miles northwest on private road, 50 feet west of road in area of rangeland:

A1—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; many fine roots; many fine pores; common worm casts; mildly alkaline; clear smooth boundary.

B21t—9 to 15 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; common fine roots; common fine pores; common worm casts; few patchy clay films; few medium and coarse pebbles of quartz; mildly alkaline; gradual smooth boundary.

B22t—15 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few fine roots;

few fine pores; common worm casts; few patchy clay films; few threads and films of calcium carbonate in lower part; mildly alkaline; gradual smooth boundary.

B23tca—38 to 68 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; about 35 percent soft masses and concretions of calcium carbonate; few patchy clay films; calcareous; moderately alkaline; gradual smooth boundary.

B24tca—68 to 80 inches; reddish yellow (5YR 6/6) clay loam, reddish yellow (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few patchy clay films; about 25 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to more than 80 inches. Depth to visible forms of calcium carbonate is 20 to 40 inches. Depth to the calcic horizon is 30 to 60 inches.

The A horizon is light brown or brown. It is neutral to mildly alkaline.

The Bt horizon is sandy clay loam or clay loam. The upper 20 inches is 25 to 35 percent clay. The upper part of the Bt horizon is reddish brown, brown, reddish yellow, or yellowish red. It is mildly to moderately alkaline. The Btca horizon is pink, light reddish brown, or reddish yellow. The calcium carbonate content ranges from 15 to 60 percent.

Aspermont series

The Aspermont series consists of deep, reddish brown, well drained soils that formed in calcareous, loamy, colluvial red-bed sediment. These soils are on foot slopes below escarpments. The slope ranges from 3 to 12 percent but is dominantly 5 to 8 percent.

Typical pedon of Aspermont silty clay loam in an area of Aspermont-Quinlan association, hilly. From intersection of U.S. Highway 287 and U.S. Highway 60 in Amarillo, about 24 miles north on U.S. Highway 287 to its intersection with Santa Fe Railroad crossing, east on private road for 6.2 miles, northeast on private road for 1.25 miles, 150 feet south of road in area of rangeland:

A1—0 to 10 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; hard, friable; common fine roots; common fine pores; few worm casts; few angular pebbles of dolomite; calcareous; moderately alkaline; gradual smooth boundary.

B21—10 to 34 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; common fine roots; common fine pores; common worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—34 to 50 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; common worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—50 to 80 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; massive; hard, firm; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 24 to 50 inches thick. It is calcareous throughout.

The A horizon is light reddish brown, reddish brown, brown, or light brown. It is loam, clay loam, or silty clay loam.

The B2 horizon is reddish brown, yellowish red, reddish yellow, light red, or red. It is loam, clay loam, or silty clay loam. The clay content is dominantly 20 to 30 percent.

The C horizon is red, reddish brown, or yellowish red. It is silt loam, silty clay loam, or loam. In some pedons weakly cemented sandstone occurs below 48 inches.

The Aspermont soils in Potter County are not within the range defined for the series because they do not have a calcic horizon. For this reason, they are considered as taxadjuncts to the series. They are similar in use and management.

Bippus series

The Bippus series consists of deep, dark grayish brown, well drained soils that formed in calcareous loamy alluvium in valley fill and along the flood plains of small streams. Slopes are 0 to 3 percent.

Typical pedon of Bippus clay loam, 0 to 1 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 7.5 miles northwest on Farm Road 1061, 0.8 mile north on private road, 50 feet west of road in area of rangeland:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; slightly hard, very friable; many fine roots; many fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

A12—7 to 25 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; common fine roots; common fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B21—25 to 48 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium

subangular blocky structure; hard, friable; few fine roots; few fine pores; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—48 to 68 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23—68 to 80 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky sturcture; slightly hard, friable; common threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 50 inches thick.

The A horizon is 15 to 30 inches thick and is clay loam or loam. It is dark brown, dark grayish brown, very dark grayish brown, or grayish brown. Reaction is mildly alkaline to moderately alkaline. Typically the soil is calcareous within a depth of 15 inches.

The B2 horizon above 60 inches is brown, grayish brown, or dark grayish brown. Below 60 inches it is reddish brown, brown, or yellowish red. Texture is clay loam or sandy clay loam. Calcium carbonate content ranges from barely visible threads and films to about 5 percent weakly cemented concretions.

Burson series

The Burson series consists of very shallow and shallow, well drained to excessively drained, reddish soils that formed in cemented sandstone interbedded with loamy and silty sediment. Slopes are dominantly 30 to 70 percent.

Typical pedon of Burson loam in an area of Burson-Quinlan-Rock outcrop association, steep. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 33 miles north on U.S. Highway 287 to its intersection with Farm Road 354, 13 miles east on Farm Road 354 to its intersection with paved park road, 3.45 miles south on park road, and 150 feet north of right-of-way in area of rangeland:

A1—0 to 6 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak fine granular structure; slightly hard, very friable; common fine roots; few fine fragments of sandstone; common dolomite and quartz pebbles on soil surface; calcareous; moderately alkaline; clear smooth boundary.

Cr—6 to 60 inches; red (2.5YR 4/6) very fine grained sandstone, dark red (2.5YR 3/6) moist; vertical and horizontal cleavage planes coated with films of calcium carbonate; calcareous; moderately alkaline.

The solum is 3 to 12 inches thick.

The A horizon is red, reddish brown, or yellowish red. It is loam, silt loam, very fine sandy loam, or silty clay loam that is calcareous throughout.

The Cr horizon is red, reddish brown, or yellowish red. It is weakly cemented, very fine grained sandstone or siltstone interbedded with strata of soft loamy or silty material. The C horizon has a hardness of less than 2, Mohs scale.

Clairemont series

The Clairemont series consists of deep, well drained, reddish brown soils that formed in calcareous, loamy alluvium of red-bed origin. Slopes are 0 to 2 percent.

Typical pedon of Clairemont silty clay loam, occasionally flooded. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 13.1 miles north on U.S. Highway 287, 2.0 miles northeast on private road, 300 feet east of road in area of rangeland:

A1—0 to 8 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C1—8 to 24 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; massive; hard, friable; common fine roots; common fine pores; few worm casts; common threads and films of calcium carbonate; faint bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—24 to 38 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; massive; hard, friable; few fine roots; few fine pores; few worm casts; common bedding planes; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C3—38 to 60 inches; reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; massive; hard, friable; few fine roots; common threads and films of calcium carbonate; common bedding planes; calcareous; moderately alkaline.

The A1 horizon is light brown, light reddish brown, brown, or reddish brown. It is 6 to 12 inches thick. Texture is silt loam or silty clay loam.

The C horizon is yellowish red, light reddish brown, reddish yellow, or reddish brown. Texture is silt loam or silty clay loam. Bedding planes are few to common.

Ector series

The Ector series consists of very shallow to shallow, well drained, brown gravelly soils that formed over limestone. Slopes range from 5 to 20 percent.

Typical pedon of Ector gravelly loam in an area of Ector-Rock outcrop association, rolling. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 24.7 miles north on U.S. Highway 287, 5.6 miles northeast on private road, 1.5 miles southeast and 0.5 mile east on private road, 3,000 feet south of road in area of rangeland:

A1—0 to 7 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; common fine pores; about 45 percent by volume limestone pebbles 3 to 8 mm in diameter; calcareous; moderately alkaline; gradual irregular boundary.

A12—7 to 11 inches; brown (7.5YR 5/2) very gravelly loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; few fine pores; about 70 percent by volume fragments of limestone coated with secondary carbonates on the lower side; calcareous; moderately alkaline; abrupt irregular boundary.

R&Cca—11 to 18 inches; fractured hard limestone of about 4 (Mohs scale); coatings of calcium carbonate on the surface.

R—18 to 60 inches; fractured limestone bedrock.

Thickness of the solum is 4 to 20 inches. Content of coarse fragments is 35 to 80 percent.

The A horizon is brown or dark brown. Texture of the fine earth fraction is loam or clay loam. The underlying limestone is many feet thick and is fractured or massive. In most places caliche coats the upper rocks and fills the cracks and crevices.

Enterprise series

The Enterprise series consists of deep, well drained, reddish brown soils that formed in calcareous, loamy wind-deposited material. These soils are on foot slopes below escarpments. The slope ranges from 3 to 8 percent.

Typical pedon of Enterprise very fine sandy loam in an area of Aspermont-Enterprise association, undulating. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 33 miles north on U.S. Highway 287 to its intersection with Farm Road 354, 13 miles east on Farm Road 354 to its intersection with paved park road, 3.25 miles south on park road, 2,800 feet west of right-of-way in area of rangeland:

A1—0 to 12 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; soft, very friable; many fine roots; many fine pores; calcareous; moderately alkaline; gradual smooth boundary.

B21—12 to 36 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; few worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—36 to 45 inches; reddish brown (2.5YR 5/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—45 to 70 inches; reddish brown (2.5YR 5/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; massive; slightly hard, friable; few faint threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 24 to about 50 inches thick. It is very fine sandy loam or loam throughout.

The A horizon is light reddish brown, reddish brown, or brown. Reaction is mildly alkaline to moderately alkaline.

The B2 and C horizons are light reddish brown, reddish brown, brown, or reddish yellow. Depth to visible carbonates is 10 to 24 inches.

Estacado series

The Estacado series consists of deep, well drained, dark grayish brown soils that formed in calcareous loamy eolian deposits on the High Plains. Slopes are 0 to 5 percent.

Typical pedon of Estacado clay loam, 1 to 3 percent slopes. From intersection of U.S. Highway 60 and Texas Highway 136 in Amarillo, 6.1 miles northeast on Texas Highway 136 to its intersection with paved county road, 0.75 mile north on county road, 3,100 feet west of right-of-way in area of rangeland:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; common fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

A12—6 to 12 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; common fine pores; common worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B21t—12 to 27 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; common fine roots; common fine pores; few worm casts; few patchy clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B22tca—27 to 58 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; few fine pores; few worm casts; few patchy clay films; about 25 percent threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—58 to 68 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; few patchy clay films; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24tca—68 to 80 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; many threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick.

The A horizon is 10 to 15 inches thick. It is grayish brown, brown, dark brown, or dark grayish brown. Texture is loam or clay loam.

The Bt horizon is brown, reddish brown, light reddish brown, or reddish yellow. Texture is clay loam. Typically, the content of visible carbonates ranges from 10 to 30 percent. Average clay content is about 30 percent.

Knoco series

The Knoco series consists of very shallow, well drained, reddish brown soils that formed in clayey red-bed shales. Slopes are dominantly 5 to 20 percent but range to 30 percent.

Typical pedon of Knoco clay in an area of Knoco-Badland association, rolling. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 19.2 miles northwest on Farm Road 1061, 2.9 miles west on private road, 3,600 feet west of windmill in area of rangeland:

A1—0 to 5 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak medium blocky structure; extremely hard, very firm; common fine roots; few fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Cr—5 to 52 inches; reddish brown (2.5YR 5/4) clayey shale, reddish brown (2.5YR 4/4) moist; massive; extremely hard, extremely firm; few fine roots in crevices of shale; few gypsum crystals in upper part; calcareous; moderately alkaline.

Thickness of the solum to red-bed shale is 3 to 12 inches. The A horizon is red, reddish brown, or yellowish red. It is clay or silty clay.

The Cr horizon is weakly consolidated clayey shale. It contains crystals and thin strata of gypsum in some places. Colors are red, reddish brown, olive gray, and white, intermingled as strata, pockets, or small discrete bodies.

Latom series

The Latom series consists of very shallow to shallow, well drained, grayish brown soils that formed in material weathered from strongly cemented sandstone. Slopes are 3 to 8 percent.

Typical pedon of Latom fine sandy loam in an area of Latom-Rock outcrop association, rolling. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 7.9 miles north on U.S. Highway 287, 1.6 miles east on paved county road, 1.0 mile east of water treatment plant in area of rangeland:

A1—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable; many fine roots; common fine pores; few fine concretions of calcium carbonate; few partly weathered fragments of sandstone in the lower part; calcareous; moderately alkaline; abrupt smooth boundary.

R—10 to 60 inches; light gray (10YR 7/2), strongly cemented, calcareous sandstone; thin coatings of calcium carbonate in crevices.

The A horizon ranges from 4 to 20 inches in thickness. It is light brown, brown, or grayish brown loam or fine sandy loam.

Likes series

The Likes series consists of deep, excessively drained, grayish brown soils that formed in calcareous windblown deposits. Slopes range from 1 to 8 percent.

Typical pedon of Likes loamy fine sand, 1 to 8 percent slopes. From intersection of U.S. Highway 60 and Texas Highway 136 in Amarillo, 0.5 mile west on private road, 3.9 miles southwest on private road, 2,000 feet south of road in area of rangeland:

A11—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

A12—6 to 14 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C1—14 to 45 inches; pale brown (10YR 6/3) loamy fine sand; brown (10YR 5/3) moist; single grained; loose; few pebbles of quartz 0.5 to 1.0 mm in diameter; calcareous; moderately alkaline; diffuse boundary.

C2—45 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few small pebbles of quartz; few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 7 to 15 inches thick. It is loamy fine sand or fine sand and is mildly to moderately alkaline. In most pedons it is calcareous. Colors are light brownish gray, grayish brown, pale brown, or brown.

The C horizon is loamy fine sand or fine sand and very pale brown, pale brown, light yellowish brown, yellowish brown, strong brown, or brown. It is calcareous and moderately alkaline.

Lincoln series

The Lincoln series consists of deep, somewhat excessively drained, light brown soils that formed in recent calcareous sandy alluvium along flood plains of streams. Slopes range from 0 to 3 percent but are dominantly less than 2 percent.

Typical pedon of Lincoln fine sand, frequently flooded. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 17.3 miles northwest on Farm Road 1061, 4,800 feet east of right-of-way in area of rangeland:

A1—0 to 9 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; common fine roots; common fine pores; calcareous; moderately alkaline; clear smooth boundary.

C—9 to 60 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grained; loose; few fine roots in upper part; few small pebbles of quartz 1 to 3 mm in diameter; few thin strata of brown (7.5YR 5/4) fine sandy loam; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout.

The A horizon ranges from 7 to 15 inches in thickness. Texture is loamy fine sand, fine sand, fine sandy loam, or clay loam. Color is light brown, reddish yellow, strong brown, or brown.

The C horizon is pinkish gray, reddish yellow, or light brownish gray. It is loamy fine sand or fine sand. These strata of slightly darker fine sandy loam range from few to common.

Lipan series

The Lipan series consists of deep, somewhat poorly drained, gray soils formed in calcareous clayey reworked eolian sediment. Slopes are 0 to 1 percent. Deep cracks form when the soil is dry.

Typical pedon of Lipan clay. From intersection of U.S. Highway 60 and Texas Highway 136 in Amarillo, 5.9 miles east on U.S. Highway 60, 0.8 mile north on paved county road, 2,800 feet west of right-of-way in area of rangeland:

A11—0 to 2 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine blocky structure; extremely hard, very firm; many fine roots; many fine pores; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

A12—2 to 20 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium blocky structure; extremely hard, very firm; many fine roots; many fine pores; few shiny pressure faces; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

AC—20 to 50 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium blocky structure; few intersecting slickensides, 3 to 10 inches across, that form parallelepipeds; extremely hard, very firm; few fine roots; few fine pores; few fine brown concretions; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—50 to 60 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; weak medium blocky structure; few intersecting slickensides that form parallelepipeds; extremely hard, very firm; few fine roots; common fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

When dry, the soil has cracks 0.5 to 1.5 inches wide that extend to depths of more than 20 inches. Gilgai microrelief is evident in undisturbed areas. The microhighs are 3 to 8 inches higher than the microlows. Grooved slickensides that intersect are below 20 inches.

The A horizon is dark gray or gray. It is mildly or moderately alkaline. Some pedons are noncalcareous in the upper 8 inches. The AC horizon is gray, grayish brown, or light brownish gray.

The Cca horizon is light brownish gray, light gray, or gray. It has few to common threads, films, and weakly cemented concretions of calcium carbonate. The AC and Cca horizons are calcareous.

Lofton series

The Lofton series consists of deep, moderately well drained, very dark gray soils formed in clayey local alluvium. Slopes range from 0 to 1 percent but are dominantly less than 0.5 percent.

Typical pedon of Lofton clay loam. From intersection of U.S. Highway 287 and Interstate Highway 40 in Amarillo, 5.8 miles east on Interstate 40, 0.3 mile south on county road, 800 feet west of right-of-way in area of rangeland:

A1—0 to 8 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable; many fine roots; many fine pores; mildly alkaline; abrupt smooth boundary.

B21t—8 to 16 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium

blocky structure; extremely hard, very firm; common fine roots between peds; common fine pores; continuous clay films on peds; few vertical cracks filled with material from above; mildly alkaline; gradual smooth boundary.

B22t—16 to 28 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; few slickensides 3 to 6 inches across; extremely hard, very firm; common fine roots; common fine pores; thin continuous clay films on peds; few fine black concretions; few vertical cracks to a depth of 26 inches; mildly alkaline; gradual smooth boundary.

B23t—28 to 42 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; few small slickensides 3 to 6 inches across; extremely hard, very firm; few fine roots; few fine pores; few patchy clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—42 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; about 10 percent soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 45 to more than 60 inches thick. Depth to visible carbonates ranges from 40 to 60 inches.

The A horizon is very dark gray, dark gray, dark grayish brown, or very dark grayish brown. It is clay loam or silty clay loam and is neutral to moderately alkaline.

The B2t horizons are gray, grayish brown, dark gray, dark grayish brown, or very dark gray. They are mildly or moderately alkaline. Texture is clay or silty clay. The clay content is 40 to 50 percent. The B3ca horizon is gray, light brownish gray, brown, or pale brown. It is clay, clay loam, silty clay, or silty clay loam. The calcium carbonate content is 5 to 40 percent.

Mangum series

The Mangum series consists of deep, moderately well drained, brown soils formed in calcareous clayey alluvium of red-bed origin. Deep cracks form when the soil is dry. Slopes are dominantly less than 1 percent. The surface is uneven.

Typical pedon of Mangum clay, occasionally flooded. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 15.2 miles northwest on Farm Road 1061, 2.1 miles northeast on private road, 2,500 feet east of road in area of rangeland:

A1—0 to 9 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; weak coarse blocky structure parting to moderate medium subangular blocky; extremely hard, very firm; common fine roots; few fine pores; calcareous; moderately alkaline; clear smooth boundary.

B—9 to 22 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak coarse blocky structure; extremely hard, very firm; few fine roots; few fine pores; few vertical cracks 1 to 1.5 cm wide; calcareous; moderately alkaline; gradual smooth boundary.

C1—22 to 42 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; massive; extremely hard, very firm; few fine roots; few very fine pores; evident bedding planes; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2—42 to 60 inches; light reddish brown (5YR 6/4) silty clay, reddish brown (5YR 5/4) moist; massive; extremely hard, very firm; evident bedding planes; common gypsum crystals; calcareous; moderately alkaline.

The soil is calcareous throughout. Texture is silty clay or clay. Clay content between depths of 10 to 40 inches is 40 to 60 percent.

The A horizon is brown, reddish brown, yellowish red, or red. It is 6 to 10 inches thick. The B and C horizons are brown, reddish brown, light reddish brown, red, reddish yellow, or yellowish red. Few to common threads, films, and concretions of calcium carbonate are in the lower part.

Mobeetie series

The Mobeetie series consists of deep, well drained, grayish brown soils formed in calcareous loamy alluvial sediment. Slopes range from 1 to 12 percent.

Typical pedon of Mobeetie fine sandy loam, 5 to 12 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1719 in Amarillo, about 7.0 miles north on Farm Road 1719 to its intersection with paved county road, 2.0 miles north on private road, 50 feet east of right-of-way in area of rangeland:

A1—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; common fine roots; common fine pores; few worm casts; few pebbles of caliche on surface; few pebbles of quartz; calcareous; moderately alkaline; gradual smooth boundary.

B2—9 to 18 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common fine roots; common fine pores; few worm casts; few strongly cemented concretions of calcium carbonate; few pebbles of quartz; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—18 to 42 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to weak medium suban-

gular blocky; slightly hard, very friable; few fine roots; few fine pores; few worm casts; common threads, films, and concretions of calcium carbonate; few pebbles of quartz; calcareous; moderately alkaline; gradual smooth boundary.

C—42 to 60 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; common fine pores; few threads and films of calcium carbonate; few quartz pebbles; calcareous; moderately alkaline.

The solum is 24 to 60 inches thick. Texture is fine sandy loam or loam.

The A horizon is brown, pale brown, light brownish gray, or grayish brown. The B2 horizon is brown, pale brown, light brownish gray, grayish brown, reddish brown, or light brown. The content of carbonates ranges from 5 to 15 percent in the B3ca horizon.

Olton series

The Olton series consists of deep, well drained, dark brown soils formed in loamy eolian deposits on the High Plains. Slopes are 0 to 3 percent.

Typical pedon of Olton clay loam, 1 to 3 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 12.0 miles northwest on Farm Road 1061, 3,000 feet west of right-of-way in area of rangeland:

A1—0 to 10 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular and subangular blocky structure; hard, friable; many fine roots; many fine pores; mildly alkaline; gradual smooth boundary.

B21t—10 to 18 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; thin clay films on peds; mildly alkaline; gradual smooth boundary.

B22t—18 to 55 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, firm; common fine roots; common fine pores; thin clay films on peds; few threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—55 to 68 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots; few fine pores; thin clay films on peds; about 15 percent soft lumps and concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B24tca—68 to 74 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; thin patchy clay films on peds; about 30 percent soft lumps of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B25t—74 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; common threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. Depth to secondary soft carbonates is 15 to 30 inches. Thickness of the mollic epipedon is 11 to 20 inches.

The A horizon is reddish brown, brown, or dark brown. Reaction is neutral to mildly alkaline.

The B2t horizon above the zone of maximum calcium carbonate accumulation is reddish brown, dark reddish brown, brown, or dark brown. Texture is clay loam. Reaction is mildly to moderately alkaline. The Btca horizon is clay loam or silty clay loam. Colors are light reddish brown, reddish yellow, or reddish brown. This horizon is calcareous and moderately alkaline. The calcium carbonate content ranges from 15 to 60 percent. The lower part of the B2t horizon is reddish brown, reddish yellow, or yellowish red. Texture is clay loam or sandy clay loam.

Owens series

The Owens series consists of shallow, well drained, reddish brown soils formed in calcareous marine clays and shales. Slopes range from 5 to about 30 percent.

Typical pedon of Owens clay in an area of Vernon-Owens association, rolling. From intersection of Farm Road 1719 and Farm Road 2176 in Amarillo, 2.0 miles west on Farm Road 1719 to its intersection with a paved county road, 1.0 mile north on paved county road, 6.1 miles northwest on paved county road, 2.2 miles northeast on private road, 100 feet north of road in area of rangeland:

A1—0 to 4 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak medium blocky structure; very hard, very firm; common fine roots; common fine pores; calcareous; moderately alkaline; clear smooth boundary.

B2ca—4 to 13 inches; weak red (10R 5/3) clay, weak red (10R 4/3) moist; few fine distinct mottles of light gray and strong brown; weak coarse blocky structure; extremely hard, very firm; few fine roots; few fine pores; few threads and films of calcium carbonate; moderately alkaline; gradual smooth boundary.

Cr—13 to 60 inches; weak red (10R 5/2) shaly clay, weak red (10R 4/2) moist; few fine distinct reddish gray and strong brown mottles; massive; extremely hard, extremely firm; calcareous; moderately alkaline.

The solum is 10 to 20 inches thick. It is calcareous throughout.

The A horizon is reddish brown, light reddish brown, or brown. Texture is clay loam or clay.

The B2ca horizon is weak red, reddish brown, or light reddish brown. The content of calcium carbonate ranges from barely visible threads and films to 5 or 10 percent in the form of soft masses or concretions.

The Cr horizon is reddish shaly clay or weakly consolidated shale.

Paloduro series

The Paloduro series consists of deep, well drained, dark brown soils formed in calcareous loamy sediment. Slopes range from 1 to 8 percent.

Typical pedon of Paloduro clay loam, 3 to 5 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 6.1 miles northwest on Farm Road 1061, 75 feet west and 20 feet south of gate in area of rangeland:

A1—0 to 12 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable; many fine roots; many fine pores; many worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21—12 to 32 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; common fine roots; common fine pores; common worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—32 to 72 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; common fine roots; common fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

B23—72 to 80 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 80 inches thick.

The A horizon is reddish brown, brown, dark brown, or grayish brown. It is loam, clay loam, or sandy clay loam.

The B2 horizon is brown, light brown, pale brown, grayish brown, or light reddish brown. Texture is loam, clay loam, or sandy clay loam. Visible calcium carbonate ranges from a few threads and films to about 12 percent by volume. The soil is moderately alkaline and calcareous throughout.

Posey series

The Posey series consists of deep, well drained, brown soils formed in calcareous loamy eolian sediment. Slopes range from 1 to 8 percent but are mainly 1 to 3 percent.

Typical pedon of Posey clay loam, 1 to 3 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1719 in Amarillo, 4.1 miles north on Farm Road 1719, 700 feet west of right-of-way in area of rangeland.

A1—0 to 7 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; many fine pores; common worm casts; calcareous; moderately alkaline; abrupt smooth boundary.

B21tca—7 to 18 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; common worm casts; few patchy clay films; few weakly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22tca—18 to 40 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; few worm casts; few patchy clay films; about 20 percent weakly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—40 to 60 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; few thin patchy clay films; about 30 percent threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24t—60 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few thin patchy clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick. It is calcareous and moderately alkaline throughout.

The A horizon is 6 to 9 inches thick. Texture is loam or clay loam. Colors are brown, light brown, grayish brown, or light reddish brown.

The Btca horizon is light reddish brown, light brown, reddish brown, reddish yellow, or yellowish red. Texture is clay loam or sandy clay loam. The content of calcium carbonate ranges from 15 to 50 percent in the form of threads, films, weakly cemented concretions, and soft masses.

Potter series

The Potter series consists of well drained, very shallow or shallow, calcareous gravelly soils formed in a mixture of loamy sediment and caliche. Slopes range from 5 to 30 percent.

Typical pedon of Potter gravelly loam in an area of Potter-Mobeetie association, steep. From intersection of Interstate Highway 40 and Farm Road 409 in Amarillo, 2.0 miles west on Interstate Highway 40 to its intersection with Helium road, 1.0 mile north on Helium road, 20 feet west of right-of-way in area of rangeland:

A1—0 to 9 inches; pinkish gray (7.5YR 6/2) gravelly loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; hard, friable; common fine roots; common fine pores; many strongly cemented concretions of calcium carbonate; few fragments of caliche up to 4 inches in diameter on surface; calcareous; moderately alkaline; abrupt smooth boundary.

C1ca—9 to 45 inches; pink (5YR 8/4) slightly platy caliche; hardness of less than 3 (Mohs scale); plates fractured; pendants of calcium carbonate on underside; calcareous; moderately alkaline; gradual irregular boundary.

C2ca—45 to 60 inches; pink (5YR 7/4) sandy clay loam; massive; about 60 percent by volume fragments and concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 4 to 12 inches thick. It is pinkish gray, light brownish gray, light brown, pale brown, brown, or grayish brown. Texture is gravelly loam, loam, or clay loam.

The Cca horizon is pink, reddish yellow, or white. It ranges from platy caliche having a hardness of less than 3 (Mohs scale) and containing soft caliche and intermingled pockets of loamy earth to soft caliche beds or loamy calcareous material.

Pullman series

The Pullman series consists of deep, well drained, brown soils formed in clayey eolian sediment. These soils are on the High Plains (fig. 16). Slopes range from 0 to 3 percent but are dominantly less than 1 percent.

Typical pedon of Pullman clay loam, 0 to 1 percent slopes. From intersection of Interstate Highway 40 and Farm Road 2381 in Bushland, 3.1 miles east on Interstate Highway 40, 3,400 feet south of right-of-way in cultivated field:

Ap—0 to 7 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; weak fine and medium granular structure; hard, friable; few fine roots; few fine pores; neutral; abrupt smooth boundary.

B21t—7 to 23 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; few wedge shaped peds; extremely hard, very firm; few fine roots on ped faces; few fine

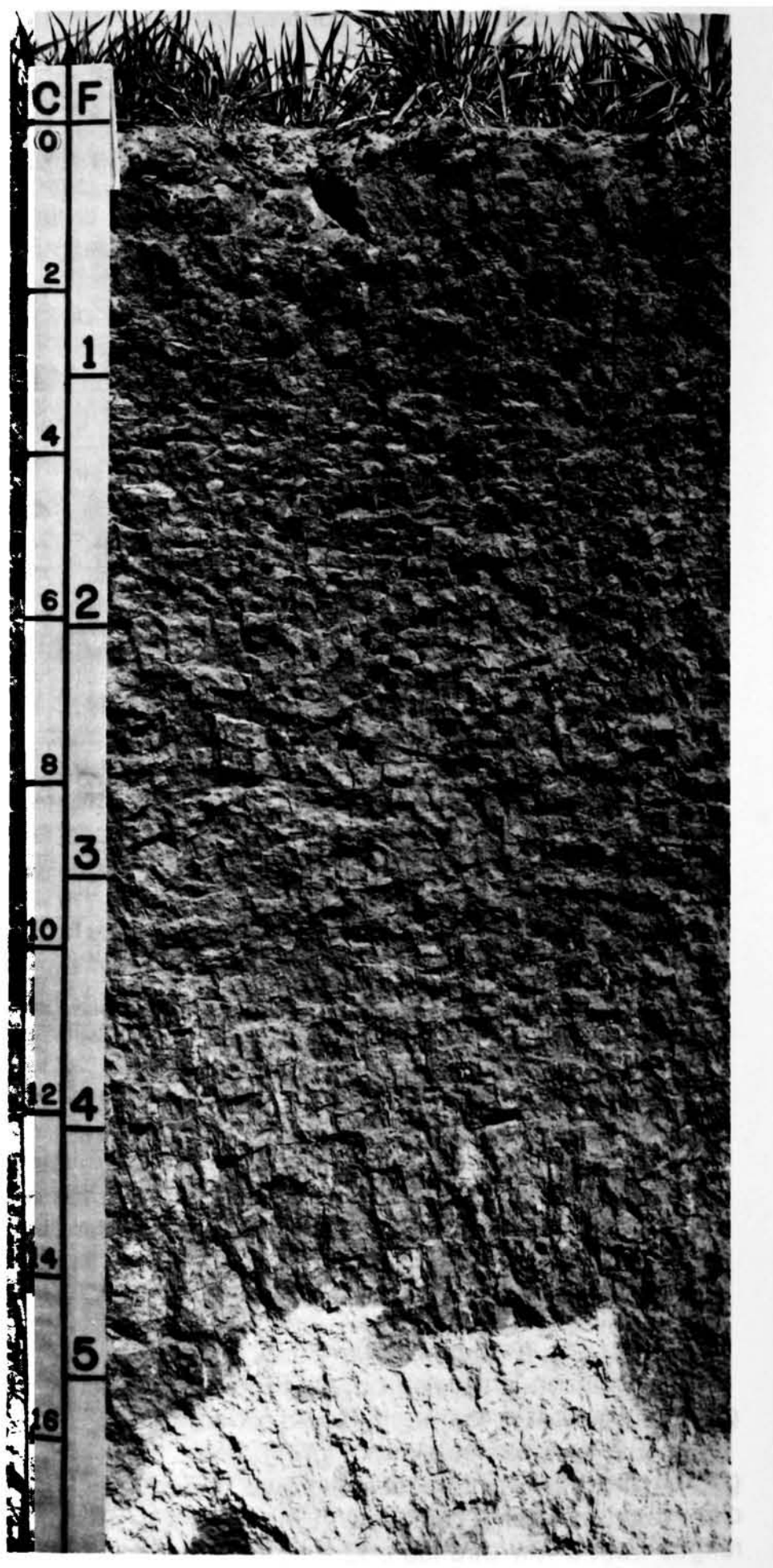


Figure 16.—Profile of Pullman clay loam, 0 to 1 percent slopes.

pores; thin continuous clay films; few vertical cracks; mildly alkaline; gradual smooth boundary.

B22t—23 to 33 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; few wedge shaped peds; few slickensides 2 to 4 inches across; extremely hard, very firm; few fine roots; few fine pores; thin continuous clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23t—33 to 45 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few pores; thin clay films on ped faces; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24t—45 to 54 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; few fine pores; few patchy clay films; common threads and films of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B25tca—54 to 72 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; moderate medium subangular blocky structure; very hard, friable; few fine pores; few patchy clay films; about 50 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual boundary.

B26tca—72 to 80 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; moderate medium subangular blocky structure; very hard, firm; few fine pores; few patchy clay films; about 30 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 75 inches thick. Depth to visible forms of calcium carbonate is 18 to 30 inches. When the soil is dry, cracks 1/4 to 1 inch wide extend to a depth of 20 inches or more.

The A horizon is grayish brown, brown, or dark grayish brown. It is clay loam or silty clay loam. Reaction is neutral to moderately alkaline.

The B21t and B22t horizons are brown or dark brown. They are mildly or moderately alkaline. The B23t and B24t horizons are reddish brown, brown, or yellowish brown. Reaction is moderately alkaline. Some pedons are calcareous. Texture in the upper part of the B2t horizon is clay or silty clay. The Btca horizon, at a depth of 30 to 60 inches, is pink, light brown, or reddish yellow. It is a clay loam or silty clay loam that is 20 to 60 percent calcium carbonate.

Quinlan series

The Quinlan series consists of shallow, well drained, reddish brown soils formed in calcareous, weakly consolidated sandstone. These soils are on side slopes and crests of knolls. Slopes are dominantly 8 to 30 percent.

Typical pedon of Quinlan very fine sandy loam in an area of Aspermont-Quinlan association, hilly. From intersection of U.S. Highway 60 and Texas Highway 136 in Amarillo, about 27 miles northeast on Texas Highway 136 to its intersection with paved park road, 4.55 miles west on park road, 50 feet south of right-of-way in area of rangeland:

A1—0 to 6 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; common fine roots; common fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B2—6 to 14 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; few worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cr—14 to 40 inches; red (2.5YR 5/6), weakly cemented calcareous sandstone.

The soil is very fine sandy loam, fine sandy loam, or loam throughout and is calcareous. Solum thickness is 10 to 20 inches.

The A horizon is red, yellowish red, or reddish brown. The B2 horizon is red, yellowish red, or reddish brown. It contains a few fragments of weathered sandstone in the lower part.

Randall series

The Randall series consists of deep, somewhat poorly drained, dark gray soils formed in alkaline, clayey, reworked eolian sediment under periodically wet conditions. Deep cracks form when the soil is dry (fig. 17).

Typical pedon of Randall clay. From intersection of U.S. Highway 60 and Farm Road 2176 in Amarillo, 0.76 mile west on U.S. Highway 60, 1,600 feet south of right-of-way in playa basin:

A1—0 to 22 inches; dark gray (10YR 4/1) clay; very dark gray (10YR 3/1) moist; moderate medium subangular blocky and fine granular structure; extremely hard, very firm; common wedge shaped peds in lower part; common fine roots; common fine pores; few worm casts; few vertical cracks; calcareous; moderately alkaline; gradual smooth boundary.

AC1—22 to 55 inches; gray (10YR 5/1) clay; dark gray (10YR 4/1) moist; moderate medium blocky structure; common wedge shaped peds; distinct intersecting slickensides; extremely hard, very firm; few fine roots; few fine pores; few small concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

AC2—55 to 66 inches; grayish brown (10YR 5/2) clay; dark grayish brown (10YR 4/2) moist; weak medium

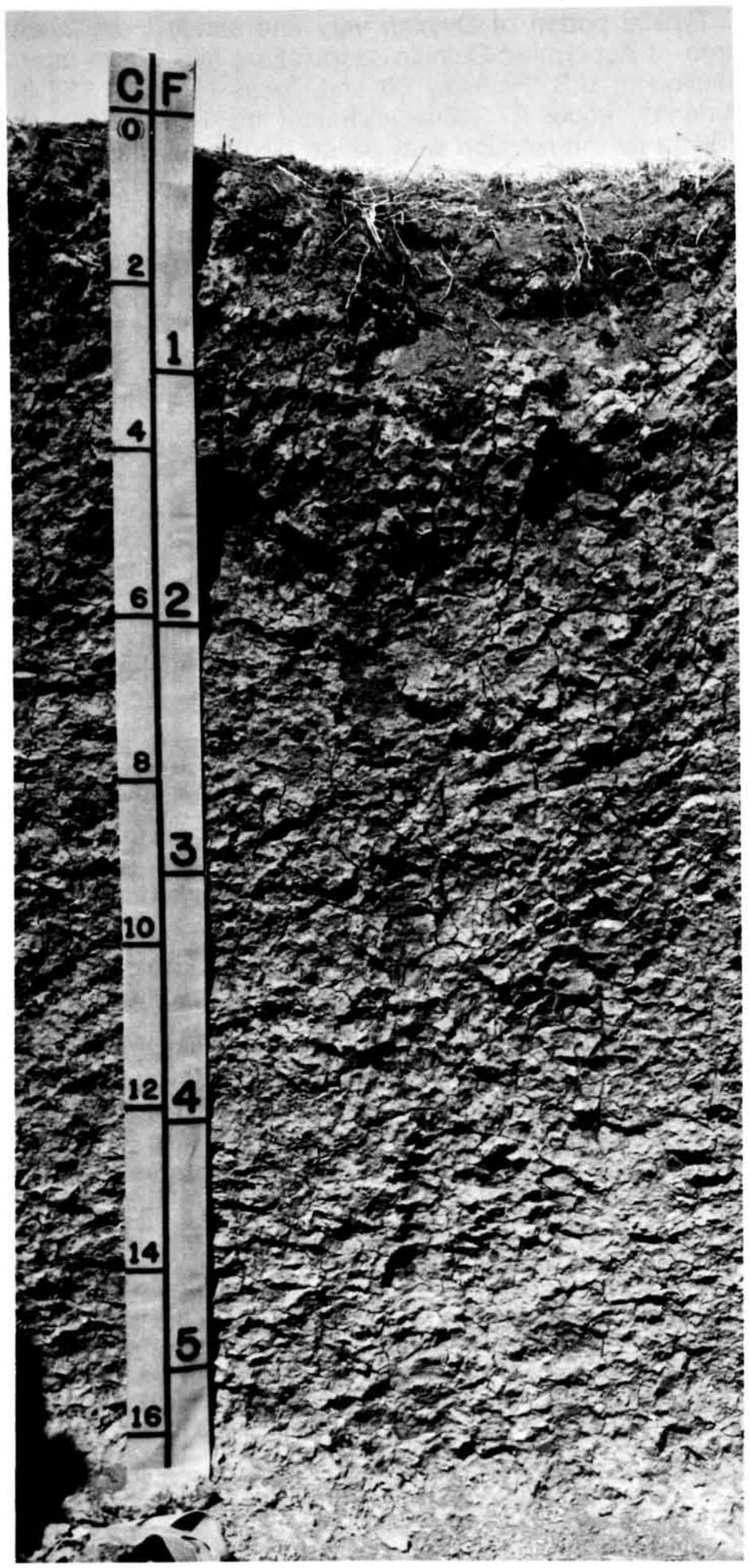


Figure 17.—Profile of Randall clay.

blocky structure; extremely hard, very firm; few slickensides 3 to 6 inches across; few fine roots; common fine strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 72 inches thick. When the soil is dry, cracks 0.5 to 1.6 inches wide extend to depths of more than 20 inches. Gilgai microrelief is evident in undisturbed areas. The microhighs are 3 to 8 inches higher than the depressions, and the cycle of recurrence is 5 to 15 feet. Intersecting slickensides are below 20 inches.

The A horizon ranges from 12 to 25 inches in thickness and is gray, dark gray, or very dark gray. It is mildly to moderately alkaline. Some pedons are calcareous. The AC horizon is gray, grayish brown, or dark grayish brown and is moderately alkaline and calcareous.

Springer series

The Springer series consists of deep, well drained, light brown soils formed in sandy eolian deposits. Slopes range from 1 to 8 percent but are commonly less than 5 percent.

Typical pedon of Springer loamy fine sand in an area of Tivoli-Springer association, undulating. From intersection of U.S. Highway 287 and Farm Road 2176 in Amarillo, 15.0 miles north on U.S. Highway 287, 100 feet east of right-of-way in area of rangeland:

A1—0 to 10 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; common fine roots; neutral; clear smooth boundary.

B21t—10 to 20 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; few fine pores; few worm casts; neutral; gradual smooth boundary.

B22t—20 to 42 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; slightly hard, very friable; few fine roots; few fine pores; neutral; gradual smooth boundary.

A'2—42 to 63 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; single grained; loose; few fine roots; few threads of calcium carbonate; mildly alkaline; clear smooth boundary.

B'2t—63 to 75 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, friable; few threads of calcium carbonate; mildly alkaline; gradual smooth boundary.

B'3—75 to 80 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, very friable; few threads and films of calcium carbonate; moderately alkaline.

The solum is 60 to more than 80 inches thick.

The A horizon is loamy fine sand 8 to 18 inches thick. Reaction is neutral or mildly alkaline. Color is light brown, brown, or pale brown.

The B2t horizon is brown, reddish brown, or yellowish red. Texture is fine sandy loam. Reaction is neutral or mildly alkaline.

The A'2 horizon is fine sand or loamy fine sand and is light brown, brown, light reddish brown, or reddish yellow.

The B'2t and B'3 horizons are reddish brown, reddish yellow, or yellowish red. Texture is fine sandy loam or sandy clay loam. Reaction is mildly or moderately alkaline.

Spur series

The Spur series consists of deep, well drained, brown soils formed in calcareous loamy alluvium along the flood plains of small streams. The slope ranges from 0 to 2 percent but is dominantly less than 1 percent.

Typical pedon of Spur clay loam in an area of Bippus and Spur soils, channeled. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 11.5 miles north on U.S. Highway 287, 1,800 feet east of right-of-way in area of rangeland:

A1—0 to 18 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B2—18 to 38 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; common worm casts; few threads and films of calcium carbonate; few strata of slightly darker material one-fourth to one-half inch thick; calcareous; moderately alkaline; gradual smooth boundary.

C1—38 to 48 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure; hard, friable; few fine roots; common fine pores; few worm casts; common threads and films of calcium carbonate; few faint bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—48 to 80 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure; hard, friable; few fine concretions of calcium carbonate; common strata of darker material; calcareous; moderately alkaline.

The A horizon is brown, dark brown, or dark grayish brown loam or clay loam. It is 10 to 20 inches thick. It is calcareous.

The B horizon is brown, reddish brown, or yellowish brown loam or clay loam. Some pedons have few to common strata of darker or lighter material.

The C horizon is brown, light reddish brown, or reddish brown. It is loam or clay loam. Bedding planes are few to common.

Tascosa series

The Tascosa series consists of deep, well drained gravelly soils formed in beds of waterworn gravel and sand (fig. 18). Slopes range from 3 to about 30 percent.

Typical pedon of Tascosa gravelly loam in an area of Tascosa association, hilly. From intersection of U.S. Highway 60 and U.S. Highway 287 in Amarillo, 9.0 miles north on U.S. Highway 287, 50 feet east of right-of-way in area of rangeland:

A1—0 to 10 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; many fine pores; common worm casts; about 35 percent by volume rounded pebbles of quartz 5 to 20 millimeters in diameter; few quartz cobbles; few concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2ca—10 to 18 inches; grayish brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common fine pores; few worm casts; about 60 percent by volume rounded pebbles of quartz 5 to 20 millimeters in diameter; few cobbles; thin coatings of calcium carbonate on lower sides of pebbles; calcareous; moderately alkaline; gradual smooth boundary.

C1ca—18 to 28 inches; very pale brown (10YR 8/4) very gravelly loam, very pale brown (10YR 7/4) moist; weak granular structure; slightly hard, very friable; few fine roots; about 60 percent by volume rounded pebbles of quartz; about 50 percent of soil material less than 2 millimeters in diameter is calcium carbonate in the form of soft masses and coatings on pebbles; calcareous; moderately alkaline; gradual smooth boundary.

C2—28 to 60 inches; very pale brown (10YR 7/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) moist; single grained; loose; 60 percent by volume rounded pebbles of quartz; about 10 percent finely divided calcium carbonate; calcareous; moderately alkaline.

The solum is 14 to 22 inches thick. The texture of the 10- to 40-inch control section is gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam. Gravel content ranges from 35 to 80 percent.

The A horizon is brown, grayish brown, or dark grayish brown. It is mildly alkaline or moderately alkaline.

The B2ca horizon is pinkish gray, light brown, light brownish gray, pale brown, grayish brown, or brown. It is

Figure 18.—Profile of Tascosa gravelly loam.

mainly more than 50 percent gravel. The calcium carbonate content is 5 to 30 percent.

The Cca horizon is very pale brown or pinkish gray. It is 20 to 35 percent calcium carbonate. The C horizon is pink or very pale brown.

Tivoli series

The Tivoli series consists of deep, brown, excessively drained sandy soils formed in thick sandy eolian sediment. Slopes range from 5 to 30 percent.

Typical pedon of Tivoli fine sand. From intersection of U.S. Highway 287 and Farm Road 2176 in Amarillo, 15.3 miles north on U.S. Highway 287, 0.5 mile east on private road, 30 feet south of road in area of rangeland:

A1—0 to 5 inches; brown (10YR 5/3) fine sand, brown (10YR 4/3) moist; single grained; loose; many fine roots; neutral; gradual smooth boundary.

C—5 to 60 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; common fine roots in upper 20 inches; mildly alkaline.

The soil is loamy fine sand or fine sand throughout.

The A horizon is 4 to 10 inches thick. Reaction is neutral or mildly alkaline. Colors are brown, light brown, or pale brown.

The C horizon is brown, light brown, very pale brown, or light yellowish brown. Reaction is neutral to moderately alkaline.

Veal series

The Veal series consists of well drained, brown soils formed in calcareous loamy sediment. Slopes range from 3 to 8 percent.

Typical pedon of Veal loam in an area of Veal-Paloduro association, undulating. From intersection of U.S. Highway 60 and Texas Highway 136 in Amarillo, 19.2 miles northeast on Texas Highway 136, 800 feet east of right-of-way in area of rangeland:

A1—0 to 6 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine subangular blocky and granular structure; slightly hard, friable; many fine roots; common pores; common worm casts; few fine fragments of cemented calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21—6 to 14 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; few worm casts; common fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B22ca—14 to 28 inches; pinkish gray (7.5YR 7/2) clay loam, pinkish gray (7.5YR 6/2) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; about 50 percent soft masses and concretions of calcium carbonate; cal-

careous; moderately alkaline; gradual smooth boundary.

B23ca—28 to 40 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; weak medium subangular blocky structure; slightly hard, friable; about 45 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24ca—40 to 60 inches; pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) moist; weak medium subangular blocky structure; slightly hard, friable; about 35 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 40 inches thick. The calcium carbonate content in the 10- to 40-inch control section is more than 40 percent.

The A horizon is 6 to 10 inches thick. Texture is loam, fine sandy loam, or clay loam. Color is brown, pale brown, light brownish gray, light brown, or grayish brown.

The B21 horizon is light brown, pale brown, brown, light yellowish brown, or grayish brown. It is sandy clay loam or clay loam. The B2ca horizon is pinkish gray, pink, very pale brown, or light reddish brown. It is loam, sandy clay loam, or clay loam.

Vernon series

The Vernon series consists of moderately deep, well drained, reddish brown soils formed in calcareous marine clays and shales. Slopes range from 1 to about 12 percent.

Typical pedon of Vernon clay in an area of Vernon-Owens association, rolling. From intersection of Farm Road 1719 and Farm Road 2176 in Amarillo, 2.0 miles west on Farm Road 1719 to its intersection with a paved county road, north on paved county road for 1.0 mile, northwest on paved county road for 6.1 miles, 2.0 miles northeast on private road, 50 feet north of road in area of rangeland:

A1—0 to 7 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; many fine roots; many fine pores; calcareous; moderately alkaline; clear smooth boundary.

B2—7 to 24 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; common fine pores; few fine strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3—24 to 38 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak coarse blocky structure; extremely hard, very firm; few fine roots; few fine pores; few fine, weakly and strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cr—38 to 60 inches; red (2.5YR 4/6) clayey shale, dark red (2.5YR 3/6) moist; few fine distinct mottles of strong brown; massive; extremely hard, extremely firm; few pockets of gray (10YR 6/1) sand; calcareous; moderately alkaline.

The solum is 20 to 40 inches thick. It is calcareous throughout.

The A horizon is reddish brown or brown. Texture is clay loam or clay.

The B horizon is reddish brown or red clay or silty clay. The content of calcium carbonate ranges from barely visible threads and films to 5 or 10 percent in the form of soft masses and concretions.

The Cr horizon is reddish brown or red. It is clayey shale or silty shale.

Weymouth series

The Weymouth series consists of moderately deep, well drained, reddish brown soils formed in calcareous clayey and loamy red-bed sediment. Slopes range from 1 to 12 percent.

Typical pedon of Weymouth clay loam, 3 to 5 percent slopes. From intersection of U.S. Highway 60 and Farm Road 1061 in Amarillo, 8.2 miles northwest on Farm Road 1061, 30 feet north of right-of-way in area of rangeland:

A1—0 to 9 inches; reddish brown (5YR 4/4) clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable; common fine roots; many fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B21—9 to 20 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; common worm casts; few medium concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—20 to 28 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; about 15 percent threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—28 to 38 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure; hard, friable; few fine roots; few fine pores; about 10 percent threads, films and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—38 to 80 inches; yellowish red (5YR 5/6) partly weathered shale and silty clay loam, yellowish red

(5YR 4/6) moist; massive; very hard, firm; common threads and films of calcium carbonate; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 20 to 40 inches thick. It is loam or clay loam and is calcareous throughout. Depth to the zone of maximum carbonate accumulation is 12 to 24 inches.

The A horizon is reddish brown, brown, or grayish brown. It is 7 to 10 inches thick.

The B2 horizon is reddish brown, brown, or yellowish red. The B3ca horizon is reddish brown, red, or yellowish red. The lower part of the B2 horizon and the B3 horizon is 5 to 30 percent visible carbonates.

The C horizon is red, reddish brown, or yellowish red. It is partly weathered silty or clayey redbeds.

Yomont series

The Yomont series consists of deep, well drained, reddish brown soils formed along flood plains of streams in calcareous loamy recent alluvium of red-bed origin.

Typical pedon of Yomont very fine sandy loam in an area of Yomont soils, frequently flooded. From intersection of U.S. Highway 287 and Farm Road 2176 in Amarillo, 19.5 miles north on U.S. Highway 287, 12.1 miles northeast on private road, 2.9 miles southeast on private road, 150 feet east of windmill in area of rangeland:

A1—0 to 16 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium granular structure; slightly hard, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; clear smooth boundary.

C1—16 to 36 inches; reddish brown (2.5YR 5/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; massive; slightly hard, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C2—36 to 60 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; hard, friable; evident bedding planes; thin strata of loamy and sandy material; calcareous; moderately alkaline.

The soil is calcareous throughout.

The A horizon is 9 to 18 inches thick. It is yellowish red, reddish brown, or light reddish brown. Texture is very fine sandy loam, silt loam, silty clay loam, or loam.

The C horizon is light reddish brown, reddish brown, yellowish red, or reddish yellow. Texture is very fine sandy loam, loam, or silty clay loam. Strata of varying texture are below 40 inches.

The Yomont soils in Potter County are not within the range defined for the series because they lack bedding planes and stratification above 36 inches and have a thicker A horizon. For this reason, they are considered as taxadjuncts to the series. They are similar in use and management.

Formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described

The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces have acted on the material. All five factors influence the characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor may dominate soil formation; in another area a different factor may be important.

The interrelationship of these factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient, however, to discuss each factor separately and to indicate the probable effects of each.

Parent material

Parent material has probably had more influence on the characteristics of the soils in Potter County than any other factor. The soils developed in two geologic formations, the High Plains deposits and the underlying Permian redbeds.

The High Plains deposits are divided into two parts. The upper part is an eolian mantle a few feet to about 100 feet thick. The lower part is the Ogallala Formation.

The eolian mantle blankets most of the High Plains part of the county. It consists of alternating layers of clay loam, clay, sandy clay loam, and loam and interbedded layers of soft pinkish-white caliche. The soil that formed at any given place appears to depend largely on the kind of parent material exposed at that place when soil formation began. For example, Pullman soils formed in material from the finer textured layers. Estacado and Posey soils are calcareous because they formed in limy layers. Acuff and Amarillo soils formed in the less calcareous loamy sediment.

Some soils formed in reworked sediment of the eolian mantle, that is, sediment that has been washed or blown since the original deposition. Randall soils formed in material washed from the surrounding slopes into playa basins. Paloduro soils formed on side slopes along draws. Bippus and Spur soils formed on flood plains.

The Ogallala Formation is 200 to about 700 feet thick. It consists of limy outwash loam, sand, and gravel. Potter soils developed in the thick beds of caliche in the upper part of the formation. Tascosa soils developed in the

beds of quartz gravel in the base of the Ogallala Formation. Likes and Tivoli soils formed in beds of wind-worked, sandy sediment. Lincoln soils formed in sandy sediment deposited along flood plains. Mobeetie soils formed in calcareous sandy loam sediment on foot slopes.

The Permian and Triassic redbeds that underlie the Ogallala Formation make up the broken escarpment and the rough areas along creeks and canyons. Ector soils formed in limestone strata at the top of the Permian beds. Vernon soils developed in clayey red-beds on slopes below the escarpment. Enterprise soils are in loamy red-beds on foot slopes.

Climate

Potter County has a dry steppe climate. The average annual precipitation is 20.28 inches (see table 1), but precipitation fluctuates greatly from year to year. Most rainfall comes in summer as short intense showers. Winter is mostly dry and windy and has little snow.

Climate has affected the soils of Potter County in several ways. For example, there has not been enough rainfall to leach carbonates out of the soil. Thus, the carbonates have accumulated in the lower part of the soils at about the average depth to which rainfall penetrates. Most soils therefore are underlain by a layer of soft, pinkish caliche.

In Acuff, Amarillo, Olton, and Pullman soils, the free carbonates have been leached out of the upper part of the solum. In Estacado and Posey soils and in other soils forming in sediment that is high in lime, the process is still going on and some free lime remains in the upper part of the solum.

In some soils, such as Pullman soils, clay is moving from the surface layer into the subsoil. Clay films, or coatings, are apparent on the surfaces of peds in the subsoil. The downward movement of clay is similar to the downward movement of carbonates, but it takes place at a much slower rate and apparently only after the carbonates have been leached out.

Local differences in climate are apparent in the escarpment area. Soils that have north-facing slopes and are protected from the sun and the warm southwesterly winds are cooler and more moist than those that have the unprotected south-facing slopes. Therefore, the grass cover on north-facing slopes is denser and taller.

Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life living on and in the soil contribute to its development. The kinds of organisms are determined mainly by climate and parent material.

The natural vegetation in Potter County consists mainly of grasses. The kind of parent material in which the soil formed determined whether the grasses would be a tall or short species. The grasses stabilize the landscape and add organic matter to the soil. The network of pores and tubes left by decaying roots helps the passage of air and water through the soils. Decaying roots also feed bacteria and fungi.

Micro-organisms are important in soil formation. They help to break down plant residue, release plant nutrients from the parent material, and fix nitrogen from the air in the soil.

Earthworms are evident in most of the soils. Worm casts are round granular excretions left by burrowing earthworms.

Rodents, such as prairie dogs and gophers, influence the development of soils. They mix the soil material vertically as well as horizontally. Nests and burrows made by rodents range from about 4 to 18 inches in diameter. They are filled with grayish brown, silty soil material that is high in content of organic matter. Rodents tend to make soil more permeable.

The grazing, trampling, and bedding of bison, deer, rabbits, antelope, and other animals have also affected soil formation.

Relief

Relief influences the formation of soils mainly through its effect on drainage and runoff. If the other factors of soil formation are equal, a difference in the degree of development of two soils depends largely on different amounts of moisture entering and passing through the soil. Some soils, such as Pullman, Acuff, Amarillo, and Olton, are nearly level to gently sloping. Most of the rainfall enters these soils; therefore relief has aided their development.

Sloping soils have more runoff and absorb less water than the more nearly level soils. Therefore, they are subject to more erosion and are generally thinner. Potter soils are gently sloping to steep. Because runoff is rapid and geologic erosion is active on these soils, time, vegetation, and climate can sustain only a very shallow soil.

Randall soils are affected by relief in another way. Periodically flooded and inundated, they gain sediment from the surrounding area each year.

Time

Time is required for the formation of a soil. The time required depends on parent material, climate, plant and animal life, and relief.

Some soils are thought to be stable in their environment. They change little as time passes, because the environmental factors have made the changes in the parent material. Acuff, Amarillo, and Pullman soils have been in place long enough to develop distinct A, B, and C horizons.

In some soils climate, plant and animal life, and relief have only begun to alter the parent material. Those factors are making their impression on the soil, but more time is needed for the formation of distinct horizons.

Thus, the age of a soil is determined by the degree to which parent material has been changed toward the full development of a soil profile that has a unique set of characteristics.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Lotspeich, F.B. and J.R. Coover. 1962. Soil forming factors on the Llano Estacado: parent material, time, and topography. Tex. J. Sci., vol. XIV, no. 1, pp. 7-17, illus.

(4) Sellards, E.H., W.S. Adkins, and F.B. Plummer. 1932. Geology of Texas, stratigraphy, vol. 1, Univ. Texas Bull. 3232, 1007 pp., illus.

(5) Texas Conservation Needs Committee. 1970. Conservation needs inventory. 297 pp., illus.

(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(7) United States Department of Agriculture. 1970. Forest statistics for Arkansas counties. Forest Serv., South. Forest Exp. Stn. Resour. Bull. SO-22, 52 pp.

(8) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(9) United States Department of Health, Education, and Welfare. 1957. Manual of septic tank practices. Public Health Serv. Publ. 526, 93 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulphate.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Low strength. The soil is not strong enough to support loads.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehold after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

TABLES

TABLE 1.--TEMPERATURE, PRECIPITATION, AND WIND DATA

Month	Temperature °F[1]					Precipitation in inches					Average wind speed (mph)	Mean number of days with temperature of			
	Normal			Extremes		Rainfall				Snow, ice pellets		Maximum		Minimum	
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest	Normal	Maximum	Minimum	Maximum in 24 hours	Maximum		90° and above	32° and below	32° and below	0° and below
January	49.4	22.5	36.0	79	-9	0.54	2.33	T[2]	1.74	12.9	13.1	0	4	26	2
February	53.0	26.4	39.7	88	0	0.56	1.83	T	1.28	17.3	14.2	0	2	22	(3)
March	60.0	31.2	45.6	94	7	0.77	3.99	T	2.27	14.7	15.5	(3)	1	14	0
April	70.9	42.1	56.5	98	18	1.23	3.74	T	1.57	6.4	15.5	1	(3)	3	0
May	79.2	51.9	65.6	99	30	2.83	9.81	0.19	6.75	T	14.8	7	0	(3)	0
June	88.0	61.2	74.6	104	43	3.45	10.73	0.01	6.15	0.0	14.4	12	0	0	0
July	91.4	65.9	78.7	104	54	2.95	7.59	0.12	4.09	0.0	12.5	22	0	0	0
August	90.4	64.7	77.6	104	52	2.93	7.55	0.39	4.26	0.0	11.9	16	0	0	0
September	82.9	56.7	69.8	100	36	1.93	5.02	0.24	3.42	T	13.0	6	0	0	0
October	72.9	46.1	59.5	94	25	1.83	7.64	0.00	3.45	3.9	13.0	2	(3)	1	0
November	60.0	32.5	46.3	82	12	0.53	2.26	T	1.29	13.6	13.2	0	1	12	0
December	51.5	25.5	38.5	76	-3	0.73	4.52	T	3.11	8.5	13.0	0	3	26	(3)
Year	70.8	43.9	57.4	104	-9	20.28	10.73	0.00	6.75	17.3	13.7	66	12	106	2

[1]Normal and extremes are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperature 108° in June 1953; lowest temperature -16° in February 1899; maximum monthly snowfall 28.7 inches in February 1903; maximum snowfall in 24 hours 20.6 inches in March 1934.

[2]T=Trace.

[3]Less than one-half day.

TABLE 2.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Percent of area	Irrigated cropland	Nonirrigated cropland	Irrigated specialty crops	Rangeland	Urban uses	Recreation areas
1. Acuff-Paloduro-Olton	32	High	High	High	Medium: droughty.	High	Medium: slope.
2. Pullman	16	High	High	High	Medium: droughty.	Low: shrink-swell, low strength.	Medium: too clayey. percs slowly.
3. Mobeetie-Tascosa	13	Very low: slope, small stones.	Very low: slope, small stones.	Very low: slope, small stones.	Medium: small stones.	Medium: slope, small stones.	Low: slope, small stones.
4. Veal-Mobeetie	12	Very low: slope, erodes easily.	Very low: slope, erodes easily.	Very low: slope, erodes easily.	Medium: rooting depth.	High	Medium: slope.
5. Weymouth-Vernon	11	Very low: slope, droughty.	Very low: slope, droughty.	Very low: slope, droughty.	Low: too clayey, droughty.	Low: shrink-swell, low strength.	Low: too clayey, slope.
6. Likes-Tivoli	7	Very low: soil blowing, slope.	Very low: soil blowing, slope.	Very low: soil blowing, slope.	High	High	Low: too sandy, slope.
7. Burson-Quinlan-Aspermont	5	Very low: slope, depth to rock.	Very low: slope, depth to rock.	Very low: slope, depth to rock.	Medium: slope, depth to rock.	Low: slope, depth to rock.	Low: slope, depth to rock.
8. Potter-Mobeetie	2	Very low: slope, rooting depth.	Very low: slope, rooting depth.	Very low: slope, rooting depth.	Low: rooting depth, small stones.	Low: slope.	Low: slope, small stones.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AcA	Acuff loam, 0 to 1 percent slopes	1,230	0.2
AcB	Acuff loam, 1 to 3 percent slopes	34,560	5.9
AcC	Acuff loam, 3 to 5 percent slopes	22,900	3.9
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes	2,670	0.5
Am	Amarillo-Urban land complex	670	0.1
APD	Aspermont-Enterprise association, undulating	5,470	0.9
AQF	Aspermont-Quinlan association, hilly	6,340	1.1
BcA	Bippus clay loam, 0 to 1 percent slopes	3,270	0.6
BcB	Bippus clay loam, 1 to 3 percent slopes	1,770	0.3
Bd	Bippus and Spur soils, channeled	4,160	0.7
BQG	Burson-Quinlan-Rock outcrop association, steep	30,660	5.2
Cc	Clairemont silty clay loam, occasionally flooded	7,440	1.3
Cm	Clairemont and Mangum soils, channeled	6,210	1.1
ERE	Ector-Rock outcrop association, rolling	4,980	0.8
EsA	Estacado clay loam, 0 to 1 percent slopes	1,280	0.2
EsB	Estacado clay loam, 1 to 3 percent slopes	12,660	2.2
EsC	Estacado clay loam, 3 to 5 percent slopes	6,550	1.1
Eu	Estacado-Urban land complex	1,810	0.3
KBE	Knoco-Badland association, rolling	3,850	0.7
LAE	Latom-Rock outcrop association, rolling	1,400	0.2
LeD	Likes loamy fine sand, 1 to 8 percent slopes	23,180	3.9
Lf	Lincoln soils, frequently flooded	4,740	0.8
Lh	Lipan clay	1,470	0.2
Ln	Lipan-Urban land complex	320	0.1
Lo	Lofton clay loam	880	0.1
Lu	Lofton-Urban land complex	400	0.1
Ma	Mangum clay, occasionally flooded	1,140	0.2
MfB	Mobeetie fine sandy loam, 1 to 3 percent slopes	2,780	0.5
MfC	Mobeetie fine sandy loam, 3 to 5 percent slopes	3,510	0.6
MfD	Mobeetie fine sandy loam, 5 to 12 percent slopes	14,580	2.5
Mo	Mobeetie-Urban land complex	600	0.1
MTE	Mobeetie-Tascosa association, rolling	29,830	5.1
MVE	Mobeetie-Veal association, rolling	31,630	5.4
OcA	Olton clay loam, 0 to 1 percent slopes	6,230	1.1
OcB	Olton clay loam, 1 to 3 percent slopes	18,320	3.1
Ou	Olton-Urban land complex	410	0.1
PaB	Paloduro clay loam, 1 to 3 percent slopes	1,660	0.3
PaC	Paloduro clay loam, 3 to 5 percent slopes	7,210	1.2
PaD	Paloduro clay loam, 5 to 8 percent slopes	2,480	0.4
PcB	Posey clay loam, 1 to 3 percent slopes	12,130	2.1
PcC	Posey clay loam, 3 to 5 percent slopes	7,740	1.3
PcD	Posey clay loam, 5 to 8 percent slopes	3,210	0.5
Pe	Posey-Urban land complex	1,580	0.2
PMG	Potter-Mobeetie association, steep	10,540	1.8
PuA	Pullman clay loam, 0 to 1 percent slopes	50,620	8.6
PuB	Pullman clay loam, 1 to 3 percent slopes	12,000	2.0
Px	Pullman-Urban land complex	10,270	1.7
Ra	Randall clay	3,350	0.6
TAF	Tascosa association, hilly	27,370	4.7
Tf	Tivoli fine sand	7,360	1.3
TSD	Tivoli-Springer association, undulating	2,260	0.4
UB	Urban land	3,160	0.5
VPD	Veal-Paloduro association, undulating	56,520	9.6
VWF	Vernon-Owens association, rolling	14,660	2.5
WeB	Weymouth clay loam, 1 to 3 percent slopes	7,660	1.3
WeC	Weymouth clay loam, 3 to 5 percent slopes	5,760	1.0
WVD	Weymouth-Vernon association, undulating	21,070	3.6
Yo	Yomont soils,frequently flooded	1,790	0.3
	Water	12,800	2.2
	Caliche pits	850	0.1
	Gravel pits	3,570	0.6
	Total	587,520	100.0

TABLE 4.--YIELDS PER ACRE OF PRINCIPAL CROPS

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields were estimated for a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Grain sorghum		Wheat	
	N	I	N	I
	Bu	Bu	Bu	Bu
Acuff:				
AcA	25	125	18	55
AcB	20	115	16	50
AcC	15	80	14	45
Amarillo:				
AfB	20	110	15	45
Bippus:				
BcA	25	130	20	60
BcB	20	115	16	55
Clairemont:				
Cc	25	125	20	60
Estacado:				
EsA	25	110	18	45
EsB	20	110	15	40
EsC	15	75	12	35
Lipan:				
Lh	20	---	15	---
Lofton:				
Lo	20	135	15	55
Mangum:				
Ma	15	---	15	---
Mobeetie:				
MfB	15	---	12	---
MfC	12	---	10	30
Olton:				
OcA	20	135	16	60
OcB	15	120	14	50
Paloduro:				
PaB	15	---	12	40
PaC	12	---	10	---
Posey:				
PcB	15	80	12	35
PcC	12	60	10	30
Pullman:				
PuA	22	135	15	60
PuB	17	125	12	50
Weymouth:				
WeB	15	---	15	---
WeC	10	---	10	---

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Acuff:					
AcA, AcB, AcC	Clay Loam	Favorable	2,100	Blue grama	30
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	10
				Sideoats grama	5
				Tobosa	5
				Other shrubs	5
				Other annual grasses	5
				Other perennial grasses	5
				Other annual forbs	5
				Other perennial forbs	5
Amarillo:					
AfB	Sandy Loam	Favorable	2,400	Blue grama	30
		Normal	2,100	Sideoats grama	15
		Unfavorable	1,400	Buffalograss	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
				Other perennial grasses	5
				Other annual forbs	5
				Other perennial forbs	5
				Other shrubs	5
Aspermont:					
[1]APD:					
Aspermont part	Clay Loam	Favorable	2,000	Blue grama	25
		Normal	1,600	Buffalograss	15
		Unfavorable	1,200	Sideoats grama	10
				Vine-mesquite	10
				Sand dropseed	5
				Western wheatgrass	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other shrubs	5
Enterprise part	Sandy Loam	Favorable	2,400	Sideoats grama	20
		Normal	1,900	Little bluestem	15
		Unfavorable	1,400	Plains bristlegrass	15
				Blue grama	10
				Vine-mesquite	10
				Sand dropseed	5
				Buffalograss	5
				Other perennial grasses	5
				Other perennial forbs	5
[1]AQF:					
Aspermont part	Clay Loam	Favorable	1,700	Blue grama	25
		Normal	1,300	Buffalograss	15
		Unfavorable	900	Sideoats grama	10
				Vine-mesquite	10
				Sand dropseed	5
				Western wheatgrass	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other shrubs	5
Aspermont:					
Quinlan part	Loamy Prairie	Favorable	2,200	Little bluestem	30
		Normal	1,800	Sand bluestem	15
		Unfavorable	1,300	Indiangrass	10
				Switchgrass	10
				Sand dropseed	10
				Blue grama	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
				Other trees	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Bippus:					
BcA, BcB	Draw	Favorable	2,600	Sideoats grama	25
		Normal	2,200	Vine-mesquite	10
		Unfavorable	1,800	Blue grama	10
				Western wheatgrass	10
				Little bluestem	5
				White tridens	5
				Buffalograss	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5
[1]Bd:					
Bippus part	Draw	Favorable	2,600	Sideoats grama	25
		Normal	2,200	Vine-mesquite	10
		Unfavorable	1,800	Blue grama	10
				Western wheatgrass	10
				Little bluestem	5
				White tridens	5
				Buffalograss	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5
Spur part	Draw	Favorable	2,600	Sideoats grama	25
		Normal	2,200	Vine-mesquite	10
		Unfavorable	1,800	Blue grama	10
				Western wheatgrass	10
				Little bluestem	5
				White tridens	5
				Buffalograss	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5
Burson:					
[1]BQG:					
Burson part	Rough Breaks	Favorable	700	Sideoats grama	20
		Normal	500	Little bluestem	15
		Unfavorable	300	Blue grama	10
				Sand bluestem	5
				Yellow indiangrass	5
				Switchgrass	5
				Hairy grama	5
				Wright threeawn	5
				Rough tridens	5
				Silver bluestem	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other shrubs	5
Quinlan part	Loamy Prairie	Favorable	2,200	Sideoats grama	35
		Normal	1,800	Little bluestem	20
		Unfavorable	1,300	Sand bluestem	5
				Yellow indiangrass	5
				Switchgrass	5
				Sand dropseed	5
				Blue grama	5
				Sideoats grama	5
				Prairie-clovers	5
				Dotted gayfeather	5
				Other trees	5
Rock outcrop.					

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Clairemont:					
Cc	Loamy Bottomland	Favorable	3,400	Sideoats grama	20
		Normal	2,600	Sand bluestem	10
		Unfavorable	1,500	Yellow indiangrass	10
				Vine-mesquite	10
				Switchgrass	5
				Little bluestem	5
				Western wheatgrass	5
				Other shrubs	10
				Other perennial grasses	5
				Other perennial forbs	5
[1]Cm:					
Clairemont part	Loamy Bottomland	Favorable	3,400	Sideoats grama	20
		Normal	2,600	Sand bluestem	10
		Unfavorable	1,500	Yellow indiangrass	10
				Vine-mesquite	10
				Switchgrass	5
				Little bluestem	5
				Western wheatgrass	5
				Other shrubs	10
				Other perennial grasses	5
				Other perennial forbs	5
Mangum part	Clayey Bottomland	Favorable	2,200	Tobosa	40
		Normal	1,500	Buffalograss	15
		Unfavorable	800	Vine-mesquite	10
				Alkali sacaton	10
				Sideoats grama	5
				Western wheatgrass	5
				Blue grama	5
				Other perennial grasses	5
Ector:					
[1]ERE:					
Ector part	Very Shallow	Favorable	900	Black grama	15
		Normal	700	Sideoats grama	15
		Unfavorable	400	Blue grama	10
				Slim tridens	5
				Wright threeawn	5
				Silver bluestem	5
				Little bluestem	5
				Fall witchgrass	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other shrubs	5
Rock outcrop.					
Estacado:					
EsA, EsB, EsC	Clay Loam	Favorable	2,200	Blue grama	30
		Normal	1,700	Sideoats grama	25
		Unfavorable	1,300	Buffalograss	15
				Vine-mesquite	5
				Other perennial grasses	10
				Other annual grasses	5
				Other annual forbs	5
				Other perennial forbs	5
Knoco:					
[1]KBE:					
Knoco part	Shallow Clay	Favorable	1,400	Sideoats grama	30
		Normal	1,000	Tobosa	15
		Unfavorable	600	Buffalograss	10
				Vine-mesquite	5
				Hairy grama	5
				Silver bluestem	5
				Purple threeawn	5
				Rough tridens	5
				Blue grama	5
				Other perennial grasses	5
				Other perennial forbs	5
Badland.					

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Latom:					
[1]LAE:					
Latom part	Very Shallow	Favorable	1,000	Sideoats grama	30
		Normal	750	Blue grama	10
		Unfavorable	500	Black grama	10
				Little bluestem	5
				Buffalograss	5
				Sand bluestem	5
				Arizona cottontop	5
				Hairy grama	5
				Silver bluestem	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other shrubs	5
Rock outcrop.					
Likes:					
LeD	Loamy Sand	Favorable	3,000	Little bluestem	20
		Normal	2,100	Sand bluestem	15
		Unfavorable	1,300	Sideoats grama	15
				Yellow indiangrass	10
				Blue grama	10
				Switchgrass	10
				Canada wildrye	5
				Hairy grama	5
				Other perennial grasses	5
				Other perennial forbs	5
Lincoln:					
Lf	Sandy Bottomland	Favorable	3,400	Switchgrass	30
		Normal	2,280	Sand bluestem	15
		Unfavorable	1,800	Yellow indiangrass	15
				Little bluestem	5
				Texas bluegrass	5
				Purpletop	5
				Maximilian sunflower	5
				Goldenrod	5
				Heath aster	5
				Other trees	5
Lipan:					
Lh	Lakebed	Favorable	4,000	Western wheatgrass	20
		Normal	2,500	Buffalograss	25
		Unfavorable	500	Vine-mesquite	10
				Blue grama	10
				Knotgrass	10
				Other perennial grass	10
				Other annual forbs	10
				Other annual grasses	5
				Other perennial forbs	5
Lofton:					
Lo	Clay Loam	Favorable	2,200	Blue grama	35
		Normal	1,800	Buffalograss	30
		Unfavorable	1,200	Vine-mesquite	10
				Western wheatgrass	5
				Sand dropseed	5
				Other perennial grasses	10
				Other perennial forbs	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Mangum:					
Ma	Clayey Bottomland	Favorable	1,900	Tobosa	40
		Normal	1,300	Buffalograss	15
		Unfavorable	700	Vine-mesquite	10
				Alkali sacaton	10
				Sideoats grama	5
				Western wheatgrass	5
				Blue grama	5
				Other perennial grasses	5
Mobeetie:					
MfB, MfC, MfD	Mixedland Slopes	Favorable	2,500	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
				Yellow indiangrass	5
				Hairy grama	5
				Other shrubs	10
				Other perennial grasses	5
				Other perennial forbs	5
[1]MTE:					
Mobeetie part	Mixedland Slopes	Favorable	2,500	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
				Yellow indiangrass	5
				Hairy grama	5
				Other shrubs	10
				Other perennial grasses	5
				Other perennial forbs	5
Tascosa part	Gravelly	Favorable	1,800	Sideoats grama	30
		Normal	1,500	Little bluestem	15
		Unfavorable	1,000	Black grama	15
				Hairy grama	10
				Blue grama	5
				Sand bluestem	5
				Yellow indiangrass	5
				Other perennial forbs	5
				Other shrubs	5
				Other perennial grasses	5
Mobeetie:					
[1]MVE:					
Mobeetie part	Mixedland Slopes	Favorable	2,500	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
				Yellow indiangrass	5
				Hairy grama	5
				Other shrubs	10
				Other perennial grasses	5
				Other perennial forbs	5
Veal part	Loamy	Favorable	2,000	Sideoats grama	40
		Normal	1,500	Blue grama	20
		Unfavorable	1,100	Buffalograss	10
				Little bluestem	5
				Sand dropseed	5
				Other perennial grasses	5
				Other perennial forbs	10
				Other shrubs	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Olton:					
OcA, OcB	Clay Loam	Favorable	2,100	Blue grama	45
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	5
				Tobosa	5
				Sideoats grama	5
				Other annual grasses	5
				Other perennial grasses	5
				Other perennial forbs	3
				Other annual forbs	2
Paloduro:					
PaB, PaC, PaD	Hardland Slopes	Favorable	2,400	Blue grama	30
		Normal	2,000	Sideoats grama	15
		Unfavorable	1,400	Buffalograss	10
				Vine-mesquite	5
				Little bluestem	5
				Silver bluestem	5
				Wright threeawn	5
				Sand dropseed	5
				Other perennial forbs	10
				Other perennial grasses	5
				Other shrubs	5
Posey:					
PcB, PcC, PcD	Loamy	Favorable	2,200	Sideoats grama	40
		Normal	1,700	Blue grama	20
		Unfavorable	1,400	Vine-mesquite	5
				Little bluestem	5
				Buffalograss	5
				Sand dropseed	5
				Other perennial grasses	5
				Other perennial forbs	10
				Other shrubs	5
Potter:					
[1]PMG:					
Potter part	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Wright threeawn	5
				Hairy grama	5
				Rough tridens	5
				Other perennial grasses	10
				Other annual grasses	5
				Other perennial forbs	5
				Other shrubs	5
Mobeetie part	Mixedland Slopes	Favorable	2,500	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
				Yellow indiangrass	5
				Hairy grama	5
				Other shrubs	10
				Other perennial grasses	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Pullman:					
PuA, PuB	Clay Loam	Favorable	2,000	Blue grama	40
		Normal	1,500	Buffalograss	25
		Unfavorable	1,000	Sideoats grama	5
				Western wheatgrass	5
				Vine-mesquite	5
				Silver bluestem	5
				Tobosa	5
				Other perennial grasses	5
				Other perennial forbs	5
Randall:					
Ra	Lakebed	Favorable	4,000	Pennsylvania smartweed	20
		Normal	2,000	Blue grama	15
		Unfavorable	500	Largespike spikesedge	15
				Buffalograss	15
				Western wheatgrass	10
				Knotgrass	5
				Other annual grasses	5
				Other annual forbs	5
				Other perennial grasses	5
				Other perennial forbs	5
Tascosa:					
[1]TAF	Gravelly	Favorable	1,800	Sideoats grama	30
		Normal	1,500	Little bluestem	15
		Unfavorable	1,000	Black grama	15
				Hairy grama	10
				Blue grama	5
				Sand bluestem	5
				Yellow indiangrass	5
				Other perennial forbs	5
				Other shrubs	5
				Other perennial grasses	5
Tivoli:					
Tf	Sand Hills	Favorable	2,000	Little bluestem	25
		Normal	1,400	Sand bluestem	20
		Unfavorable	1,000	Big sandreed	10
				Sideoats grama	10
				Sand lovegrass	5
				Switchgrass	5
				Sand dropseed	5
				Perennial lespedezas	5
				Other perennial forbs	5
				Other perennial grasses	5
				Other trees	5
[1]TSD:					
Tivoli part	Sand Hills	Favorable	2,000	Little bluestem	25
		Normal	1,400	Sand bluestem	20
		Unfavorable	1,000	Big sandreed	10
				Sideoats grama	10
				Sand lovegrass	5
				Switchgrass	5
				Sand dropseed	5
				Perennial lespedezas	5
				Other perennial forbs	5
				Other perennial grasses	5
				Other trees	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Springer part----	Loamy Sand----------	Favorable	2,800	Little bluestem----------	15
		Normal	1,800	Sideoats grama----------	10
		Unfavorable	1,200	Blue grama----------	10
				Plains bristlegrass----------	5
				Sand dropseed----------	5
				Sand bluestem----------	5
				Yellow indiangrass----------	5
				Switchgrass----------	5
				Other perennial grasses-------	10
				Other shrubs----------	10
				Other perennial forbs---------	5
Veal:					
[1]VPD:					
Veal part--------	Loamy----------	Favorable	2,000	Sideoats grama----------	30
		Normal	1,500	Blue grama----------	15
		Unfavorable	1,100	Buffalograss----------	10
				Little bluestem----------	5
				Sand dropseed----------	5
				Other perennial grasses-------	10
				Other perennial forbs---------	10
				Other shrubs----------	10
Paloduro part----	Hardland Slopes----------	Favorable	2,400	Blue grama----------	30
		Normal	2,000	Sideoats grama----------	15
		Unfavorable	1,400	Buffalograss----------	10
				Vine-mesquite----------	5
				Little bluestem----------	5
				Silver bluestem----------	5
				Wright threeawn----------	5
				Sand dropseed----------	5
				Other perennial forbs---------	10
				Other perennial grasses-------	5
				Other shrubs----------	5
Vernon:					
[1]VWF:					
Vernon part------	Shallow Clay----------	Favorable	1,750	Sideoats grama----------	25
		Normal	1,350	Buffalograss----------	15
		Unfavorable	900	Tobosa----------	15
				Vine-mesquite----------	5
				Hairy grama----------	5
				Silver bluestem----------	5
				Black grama----------	5
				Blue grama----------	5
				Other perennial grasses-------	10
				Other perennial forbs---------	5
				Other shrubs----------	5
Owens part-------	Shallow Clay----------	Favorable	1,600	Sideoats grama----------	30
		Normal	1,250	Silver bluestem----------	15
		Unfavorable	900	Buffalograss----------	10
				Vine-mesquite----------	10
				Hairy grama----------	5
				Rough tridens----------	5
				Other perennial grasses-------	5
				Other perennial forbs---------	5
				Other shrubs----------	5
Weymouth:					
WeB, WeC----------	Clay Loam----------	Favorable	2,000	Blue grama----------	30
		Normal	1,600	Buffalograss----------	15
		Unfavorable	1,200	Tobosa----------	15
				Vine-mesquite----------	10
				Sideoats grama----------	5
				Other perennial grasses-------	15
				Other perennial forbs---------	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
[1]WVD:					
Weymouth part----	Clay Loam----------	Favorable	2,000	Blue grama----------	30
		Normal	1,600	Buffalograss----------	15
		Unfavorable	1,200	Tobosa----------	15
				Vine-mesquite----------	10
				Sideoats grama----------	5
				Other perennial grasses-------	15
				Other perennial forbs---------	5
Vernon part------	Shallow Clay----------	Favorable	1,750	Sideoats grama----------	25
		Normal	1,350	Buffalograss----------	15
		Unfavorable	900	Tobosa----------	15
				Vine-mesquite----------	5
				Hairy grama----------	5
				Silver bluestem----------	5
				Blue grama----------	5
				Other perennial grasses-------	10
				Other perennial forbs---------	5
				Other shrubs----------	5
Yomont:					
[1]Yo----------	Loamy Bottomland----------	Favorable	3,600	Sand bluestem----------	15
		Normal	2,700	Sideoats grama----------	15
		Unfavorable	1,750	Yellow indiangrass----------	10
				Western wheatgrass----------	10
				Switchgrass----------	5
				Little bluestem----------	5
				Vine-mesquite----------	5
				Other perennial grasses-------	10
				Other perennial forbs---------	5
				Other shrubs----------	5

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the map unit.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Absence of an entry means the species does not grow well on the soil]

Soil name and map symbol	Expected heights in feet of specified trees at 20 years of age							
	Siberian elm	Honey-locust	Russian olive	Oriental arbor-vitae	Eastern redcedar	Arizona cypress	Green ash	Osage-orange
Acuff: AcA, AcB, AcC	30	25	12	18	15	15	15	15
Amarillo: AfB, [1]Am	35	30	15	20	15	20	20	20
Aspermont: [1]APD:								
Aspermont part	30	25	15	15	15	--	--	15
Enterprise part	35	30	15	20	15	20	20	20
[1]AQF:								
Aspermont part	30	25	15	15	15	--	--	15
Quinlan part	--	--	--	--	15	--	--	--
Bippus: BcA, BcB	35	30	15	20	15	20	20	20
[1]Bd:								
Bippus part	35	30	15	20	15	20	20	20
Spur part	35	30	15	20	15	20	20	20
Burson: [1]BQG:								
Burson part	--	--	--	--	--	--	--	--
Quinlan part	--	--	--	--	15	--	--	--
Rock outcrop								
Clairemont: Cc	35	30	15	20	15	20	20	20
[1]Cm:								
Clairemont part	35	30	15	20	15	20	20	20
Mangum part	--	--	--	--	--	--	--	--
Ector: [1]ERE:								
Ector part	--	--	--	--	--	--	--	--
Rock outcrop	--	--	--	--	--	--	--	--
Estacado: EsA, EsB, EsC, [1]Eu-	30	--	--	15	15	--	--	15
Knoco: [1]KBE:								
Knoco part	--	--	--	--	--	--	--	--
Badland part	--	--	--	--	--	--	--	--
Latom: [1]LAE:								
Latom part	--	--	--	--	--	--	--	--
Rock outcrop	--	--	--	--	--	--	--	--
Likes: LeD	--	--	--	--	--	--	--	--

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights in feet of specified trees at 20 years of age							
	Siberian elm	Honey-locust	Russian olive	Oriental arbor-vitae	Eastern redcedar	Arizona cypress	Green ash	Osage-orange
Lincoln: [1]Lf	--	--	--	--	--	--	--	--
Lipan: Lh, [1]Ln	--	--	--	--	--	--	--	--
Lofton: Lo	30	25	15	20	20	--	--	--
Lofton: [1]Lu:								
Lofton part	30	25	15	20	20	--	--	--
Urban land part	--	--	--	--	--	--	--	--
Mangum: Ma	--	--	--	--	--	--	--	--
Mobeetie: MfB, MfC, MfD, [1]Mo-	35	25	15	20	15	20	20	15
[1]MTE:								
Mobeetie part	35	25	15	20	15	20	20	15
Tascosa part	--	--	--	--	--	--	--	--
[1]MVE:								
Mobeetie part	35	25	15	20	15	20	20	15
Veal part	25	20	15	15	15	--	--	15
Olton: OcA, OcB, [1]Ou	30	25	12	18	15	15	15	15
Paloduro: PaB, PaC, PaD	30	25	--	15	15	20	--	15
Posey: PcB, PcC, PcD, [1]Pe-	30	25	--	15	15	20	--	15
Potter: [1]PMG:								
Potter part	--	--	--	--	--	--	--	--
Mobeetie part	35	25	15	20	15	20	20	15
Pullman: PuA, PuB, [1]Px	30	25	12	18	20	20	--	15
Randall: Ra	--	--	--	--	--	--	--	--
Tascosa: [1]TAF	--	--	--	--	--	--	--	--
Tivoli: Tf	--	--	--	--	--	--	--	--
[1]TSD:								
Tivoli part	--	--	--	--	--	--	--	--
Springer part	35	30	15	20	15	20	20	20
Urban land: UB	--	--	--	--	--	--	--	--
Veal: [1]VPD:								
Veal part	25	20	15	15	15	--	--	15
Paloduro part	30	25	--	15	15	20	--	15

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights in feet of specified trees at 20 years of age							
	Siberian elm	Honey-locust	Russian olive	Oriental arbor-vitae	Eastern redcedar	Arizona cypress	Green ash	Osage-orange
Vernon:								
[1]VWF:								
Vernon part-------	--	--	--	--	--	--	--	--
Owens part--------	--	--	--	--	--	--	--	--
Weymouth:								
WeB, WeC----------	30	25	15	15	15	--	--	15
[1]WVD:								
Weymouth part-----	30	25	15	15	15	--	--	15
Vernon part-------	--	--	--	--	--	--	--	--
Yomont:								
[1]Yo---------------	35	30	15	20	15	20	20	20

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Acuff:				
AcA	Slight	Slight	Slight	Slight.
AcB, AcC	Slight	Slight	Moderate: slope.	Slight.
Amarillo:				
AfB	Slight	Slight	Moderate: slope.	Slight.
[1]Am:				
Amarillo part	Slight	Slight	Moderate: slope.	Slight.
Urban land.				
Aspermont:				
[1]APD:				
Aspermont part	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
Enterprise part	Slight	Slight	Moderate: slope.	Slight.
[1]AQF:				
Aspermont part	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Quinlan part	Severe: slope.	Severe: slope.	Severe: depth to rock.	Moderate: slope.
Bippus:				
BcA	Severe: floods.	Slight	Moderate: floods.	Slight.
BcB	Slight	Slight	Slight	Slight.
[1]Bd:				
Bippus part	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Spur part	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Burson:				
[1]BQG:				
Burson part	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
Quinlan part	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.
Rock outcrop.				

See footnote at end of page.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Clairemont: Cc	Severe: floods.	Moderate: dusty.	Moderate: dusty.	Moderate: too clayey.
[1]Cm: Clairemont part	Severe: floods.	Moderate: dusty, floods.	Moderate: dusty, floods.	Moderate: too clayey.
Mangum part	Severe: floods, percs slowly.	Severe: floods.	Severe: percs slowly, floods.	Severe: floods.
Ector: [1]ERE: Ector part	Severe: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, slope.	Moderate: slope, small stones.
Rock outcrop.				
Estacado: EsA	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
EsB, EsC	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope.	Moderate: too clayey.
[1]Eu: Estacado part	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope.	Moderate: too clayey.
Urban land.				
Knoco: [1]KBE: Knoco part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Badland part.				
Latom: [1]LAE: Latom part	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
Rock outcrop.				
Likes: LeD	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Lincoln: [1]Lf	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Lipan: Lh	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.
[1]Ln: Lipan part	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.	Severe: floods, percs slowly. too clayey.	Severe: floods, too clayey.
Urban land.				

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lofton: Lo	Severe: percs slowly.	Moderate: too clayey, wetness.	Severe: percs slowly.	Moderate: too clayey.
[1]Lu: Lofton part	Severe: percs slowly.	Moderate: too clayey, wetness.	Severe: percs slowly.	Moderate: too clayey.
Urban land.				
Mangum: Ma	Severe: percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.
Mobeetie: MfB, MfC	Slight	Slight	Moderate: slope.	Slight.
[1]Mo: Mobeetie part	Slight	Slight	Moderate: slope.	Slight.
Urban land.				
MfD	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]MTE: Mobeetie part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Tascosa part	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
Mobeetie: [1]MVE: Mobeetie part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Veal part	Slight	Slight	Severe: slope.	Slight.
Olton: OcA, OcB	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
[1]Ou: Olton part	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
Urban land.				
Paloduro: PaB, PaC	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
PaD	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Posey: PcB, PcC	Slight	Slight	Moderate: slope.	Slight.
PcD	Slight	Slight	Severe: slope.	Slight.
[1]Pe:				

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Posey:				
Posey part	Slight	Slight	Moderate slope.	Slight.
Urban land.				
Potter:				
[1]PMG:				
Potter part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Mobeetie part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pullman:				
PuA, PuB	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
[1]Px:				
Pullman part	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
Urban land.				
Randall:				
Ra	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Tascosa:				
[1]TAF	Severe:	Severe:	Severe:	Moderate:
Tivoli:				
Tf	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.
[1]TSD:				
Tivoli part	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.
Springer part	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Veal:				
[1]VPD:				
Veal:	Slight	Slight	Moderate: slope.	Slight.
Veal:				
Paloduro part	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
Vernon:				
[1]VWF:				
Vernon part	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Owens part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.
Weymouth:				
WeB, WeC	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
[1]WVD:				
Weymouth part-------	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Vernon part---------	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Yomont:				
[1]Yo----------	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 8.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Acuff: AcA, AcB, AcC	Fair	Fair	Fair	Fair	Fair	Fair.
Amarillo: AfB	Fair	Fair	Fair	Fair	Fair	Fair.
Aspermont: [1]APD:						
Aspermont part	Poor	Fair	Fair	Fair	Fair	Fair.
Enterprise part	Fair	Good	Good	Good	Good	Good.
[1]AQF:						
Aspermont part	Poor	Fair	Fair	Fair	Fair	Fair.
Quinlan part	Poor	Poor	Fair	Poor	Fair	Poor.
Bippus: BcA	Good	Good	Good	Good	Good	Good.
BcB	Fair	Good	Good	Good	Good	Good.
[1]Bd:						
Bippus part	Very poor.	Poor	Fair	Good	Poor	Fair.
Spur part	Very poor.	Poor	Fair	Good	Poor	Fair.
Burson: [1]BQG:						
Burson part	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Quinlan part	Very poor.	Very poor.	Fair	Poor	Poor	Poor.
Rock outcrop.						
Clairemont: Cc	Good	Good	Fair	Good	Good	Fair.
[1]Cm:						
Clairemont part	Very poor.	Poor	Fair	Good	Poor	Fair.
Mangum part	Poor	Fair	Poor	Fair	Poor	Poor.
Ector: [1]ERE:						
Ector part	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Rock outcrop.						
Estacado: EsA, EsB, EsC	Fair	Fair	Fair	Fair	Fair	Fair.
Knoco: [1]KBE:						
Knoco part	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Badland part.						

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Latom:						
[1]LAE:						
Latom part	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Rock outcrop.						
Likes:						
LeD	Poor	Fair	Good	Good	Fair	Good.
Lincoln:						
[1]Lf	Poor	Fair	Fair	Fair	Fair	Fair.
Lipan:						
Lh	Fair	Fair	Fair	Very poor.	Fair	Poor.
Lofton:						
Lo	Fair	Good	Fair	Fair	Fair	Fair.
Lofton:						
[1]Lu:						
Lofton part	Fair	Good	Fair	Fair	Fair	Fair.
Urban land.						
Mangum:						
Ma	Fair	Fair	Poor	Fair	Fair	Poor.
Mobeetie:						
MfB, MfC	Fair	Fair	Fair	Fair	Fair	Fair.
MfD	Poor	Fair	Fair	Fair	Fair	Fair.
[1]MTE:						
Mobeetie part	Poor	Fair	Fair	Fair	Fair	Fair.
Tascosa part	Poor	Poor	Fair	Poor	Poor	Poor.
[1]MVE:						
Mobeetie part	Poor	Fair	Fair	Fair	Fair	Fair.
Veal part	Poor	Fair	Fair	Fair	Fair	Fair.
Olton:						
OcA, OcB	Fair	Fair	Fair	Fair	Fair	Fair.
Paloduro:						
PaB, PaC, PaD	Fair	Fair	Fair	Fair	Fair	Fair.
Posey:						
PcB, PcC	Fair	Fair	Fair	Fair	Fair	Fair.
PcD	Poor	Fair	Fair	Fair	Fair	Fair.
Potter:						
[1]PMG:						
Potter part	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Mobeetie part	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Pullman:						
PuA, PuB	Fair	Fair	Fair	Fair	Fair	Fair.
Randall:						
Ra	Poor	Poor	Fair	Poor	Poor	Poor.
Tascosa:						
[1]TAF	Poor	Poor	Fair	Poor	Poor	Poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Tivoli:						
Tf	Poor	Poor	Fair	Poor	Poor	Poor.
[1]TSD:						
Tivoli part	Poor	Poor	Fair	Poor	Poor	Poor.
Springer part	Poor	Fair	Fair	Fair	Fair	Fair.
Veal:						
[1]VPD:						
Veal part	Poor	Fair	Fair	Fair	Fair	Fair.
Paloduro part	Fair	Fair	Fair	Fair	Fair	Fair.
Vernon:						
[1]VWF:						
Vernon part	Fair	Fair	Poor	Fair	Fair	Fair.
Owens part	Poor	Fair	Fair	Poor	Fair	Poor.
Weymouth:						
WeB, WeC	Fair	Good	Fair	Fair	Fair	Fair.
[1]WVD:						
Weymouth part	Poor	Fair	Fair	Fair	Fair	Fair.
Vernon part	Fair	Fair	Poor	Fair	Fair	Fair.
Yomont:						
[1]Yo	Very poor.	Poor	Fair	Good	Poor	Fair.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Acuff:					
AcA, AcB, AcC	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Amarillo:					
AfB	Slight	Slight	Slight	Slight	Moderate: low strength.
[1]Am:					
Amarillo part	Slight	Slight	Slight	Slight	Moderate: low strength.
Urban land.					
Aspermont:					
[1]APD:					
Aspermont part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Moderate: low strength, shrink-swell.
Enterprise part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
[1]AQF:					
Aspermont part	Moderate: slope, too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: slope.	Moderate: slope, low strength, shrink-swell.
Quinlan part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Bippus:					
BcA	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
BcB	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
[1]Bd:					
Bippus part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Spur part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Burson:					
[1]BQG:					
Burson part	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Quinlan part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
Clairemont:					
Cc	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
[1]Cm: Clairemont part---	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Mangum part-------	Severe: floods, too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Ector: [1]ERE: Ector part--------	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Rock outcrop.					
Estacado: EsA, EsB, EsC------	Slight----------	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
[1]Eu: Estacado part-----	Slight----------	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Urban land.					
Knoco: [1]KBE: Knoco part--------	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Badland.					
Latom: [1]LAE: Latom part--------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop.					
Likes: LeD----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
Lincoln: [1]Lf----------	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Lipan: Lh----------	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
[1]Ln: Lipan part--------	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Urban land.					
Lofton: Lo----------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Lofton: [1]Lu: Lofton part-------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Urban land.					

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Mangum:					
Ma	Severe: floods, too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Mobeetie:					
MfB	Slight	Slight	Slight	Slight	Slight.
MfC	Slight	Slight	Slight	Moderate: slope.	Slight.
MfD	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
[1]Mo:					
Mobeetie part	Slight	Slight	Slight	Slight	Slight.
Urban land.					
[1]MTE:					
Mobeetie part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Tascosa part	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
[1]MVE:					
Mobeetie part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Veal part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength.
Olton:					
OcA, OcB	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, shrink-swell.
[1]Ou:					
Olton part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength. shrink-swell.
Urban land.					
Paloduro:					
PaB	Slight	Slight	Slight	Slight	Slight.
PaC, PaD	Slight	Slight	Slight	Moderate: slope.	Slight.
Posey:					
PcB	Slight	Slight	Slight	Slight	Slight.
PcC, PcD	Slight	Slight	Slight	Moderate: slope.	Slight.
[1]Pe:					
Posey part	Slight	Slight	Slight	Moderate: slope.	Slight.
Urban land.					
Potter:					
[1]PMG:					
Potter part	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Mobeetie part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Pullman: PuA, PuB	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]Px: Pullman part	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Urban land.					
Randall: Ra	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.
Tascosa: [1]TAF	Severe: small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tivoli: Tf	Severe: cutbanks cave, too sandy.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
[1]TSD: Tivoli part	Severe: cutbanks cave, too sandy.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Springer part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Veal: [1]VPD: Veal part	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Paloduro part	Slight	Slight	Slight	Moderate: slope.	Slight.
Vernon: [1]VWF: Vernon part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Owens part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell.
Weymouth: WeB	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
WeC	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
[1]WVD: Weymouth part	Moderate: slope, too clayey.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
[1]WVD: Vernon part-------	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Yomont: [1]Yo----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 10.--SANITARY FACILITIES

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Acuff:					
AcA, AcB, AcC	Slight	Moderate: seepage.	Slight	Slight	Good.
Amarillo:					
AfB	Slight	Moderate: seepage.	Slight	Slight	Good.
[1]Am:					
Amarillo part	Slight	Moderate:	Slight	Slight	Good.
Urban land.					
Aspermont:					
[1]APD:					
Aspermont part	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Enterprise part	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
[1]AQF:					
Aspermont part	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
Quinlan part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Moderate: depth to rock.	Severe: slope.	Poor: thin layer.
Bippus:					
BcA	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.	Fair: too clayey.
BcB	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]Bd:					
Bippus part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Spur part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Burson:					
[1]BQG:					
Burson part	Severe: slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, slope.
Quinlan part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Poor: thin layer.
Rock outcrop.					
Clairemont:					
Cc	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
[1]Cm: Clairemont part---	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Mangum part-------	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.
Ector: [1]ERE: Ector part--------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones.
Rcok outcrop.					
Estacado: EsA, EsB, EsC------	Slight----------	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
[1]Eu: Estacado part-----	Slight----------	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Urban land.					
Knoco: [1]KBE: Knoco part--------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Badland.					
Latom: [1]LAE: Latom part--------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Rock outcrop.					
Likes: LeD----------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
Lincoln: [1]Lf----------	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
Lipan: Lh----------	Severe: floods, percs slowly.	Slight----------	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
[1]Ln: Lipan part--------	Severe: floods, percs slowly.	Slight----------	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
Urban land.					
Lofton: Lo----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey.
Lofton: [1]Lu: Lofton part-------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey.
Urban land.					

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mangum: Ma	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.
Mobeetie: MfB, MfC	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
MfD	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
[1]Mo: Mobeetie part	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Urban land.					
[1]MTE: Mobeetie part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
Tascosa part	Moderate: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
[1]MVE: Mobeetie part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
Veal part	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Olton: OcA	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
OcB	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]Ou: Olton part	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
Paloduro: PaB, PaC, PaD	Slight	Moderate: seepage.	Slight	Slight	Fair: too clayey.
Posey: PcB, PcC, PcD	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
[1]Pe: Posey part	Severe: seepage.	Moderate: slope, seepage.	Slight	Slight	Good.
Urban land.					

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Potter:					
[1]PMG:					
Potter part	Severe: seepage.	Severe: slope.	Moderate: small stones.	Moderate: slope.	Poor: thin layer.
Mobeetie part	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope.	Poor: slope.
Pullman:					
PuA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
PuB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
[1]Px:					
Pullman part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Urban land.					
Randall:					
Ra	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: floods.	Poor: too clayey, wetness.
Tascosa:					
[1]TAF	Severe: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Tivoli:					
Tf	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
[1]TSD:					
Tivoli part	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Springer part	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
Veal:					
[1]VPD:					
Veal part	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Paloduro part	Slight	Moderate: seepage.	Slight	Slight	Fair. slope.
Vernon:					
[1]VWF:					
Vernon part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Owens part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, area reclaim.
Weymouth: WeB, WeC	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]WVD: Weymouth part	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Vernon part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Yomont: [1]Yo	Severe: floods.	Severe: floods, seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Acuff:				
AcA, AcB, AcC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Amarillo:				
AfB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]Am:				
Amarillo part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land.				
Aspermont:				
[1]APD:				
Aspermont part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Enterprise part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]AQF:				
Aspermont part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Quinlan part	Fair: low strength.	Unsuited: excess fines.	Unsuited excess fines.	Poor: slope.
Bippus:				
BcA, BcB	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]Bd:				
Bippus part	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Spur part	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Burson:				
[1]BQG:				
Burson part	Poor: slope, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
Quinlan part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Rock outcrop.				
Clairemont:				
Cc	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]Cm:				
Clairemont part	Fair: low strength.	Unsuited	Unsuited	Fair: too clayey.
Mangum part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ector: [1]ERE: Ector part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Rock outcrop:				
Estacado: EsA, EsB, EsC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
[1]Eu: Estacado part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
Urban land.				
Knoco: [1]KBE: Knoco part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Badland.				
Latom: [1]LAE: Latom part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Rock outcrop.				
Likes: LeD	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Lincoln: [1]Lf	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Lipan: Lh	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]Ln: Lipan part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land.				
Lofton: Lo	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lofton: [1]Lu: Lofton part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land.				
Mangum: Ma	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mobeetie:				
MfB, MfC	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
MfD	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
[1]Mo:				
Mobeetie part	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Urban land.				
[1]MTE:				
Mobeetie part	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
Tascosa part	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
[1]MVE:				
Mobeetie part	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Veal part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Olton:				
OcA, OcB	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]Ou:				
Olton part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land.				
Paloduro:				
PaB, PaC, PaD	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Posey:				
PcB, PcC, PcD	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
[1]Pe:				
Posey part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
Urban land.				
Potter:				
[1]PMG:				
Potter part	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Mobeetie part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pullman: PuA, PuB	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]Px: Pullman part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land.				
Randall: Ra	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Tascosa: [1]TAF	Fair: slope.	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
Tivoli: Tf	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
[1]TSD: Tivoli part	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Springer part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Veal: [1]VPD: Veal part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Paloduro part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Vernon: [1]VWF: Vernon part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Owens part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Weymouth: WeB, WeC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]WVD: Weymouth part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Vernon part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Yomont: [1]Yo	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 12.--WATER MANAGEMENT

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Acuff:					
AcA, AcB, AcC----	Moderate: seepage.	Moderate: seepage.	Erodes easily-----	Favorable---------	Favorable.
Amarillo:					
AfB,----------	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily-----	Favorable---------	Favorable.
[1]Am:					
Amarillo part---	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily-----	Favorable---------	Favorable.
Urban land.					
Aspermont:					
[1]APD:					
Aspermont part--	Moderate: seepage.	Moderate: compressible, piping.	Slope----------	Slope, piping.	Erodes easily, slope.
Enterprise part-	Severe: seepage.	Moderate: piping, unstable fill.	Fast intake-------	Erodes easily-----	Favorable.
[1]AQF:					
Aspermont part--	Moderate: seepage.	Moderate: compressible, piping.	Slope----------	Slope, piping.	Erodes easily, slope.
Quinlan part----	Severe: depth to rock.	Severe: thin layer.	Droughty, slope, rooting depth.	Depth to rock, slope.	Droughty, slope, rooting depth.
Bippus:					
BcA----------	Moderate: seepage.	Moderate: low strength, shrink-swell.	Favorable---------	Favorable---------	Favorable.
BcB----------	Moderate: seepage.	Moderate: low strength, shrink-swell.	Erodes easily-----	Favorable---------	Favorable.
[1]Bd:					
Bippus part-----	Moderate: seepage.	Moderate: low strength, shrink-swell.	Floods----------	Favorable---------	Favorable.
Spur part-------	Moderate: seepage.	Moderate: low strength, shrink-swell.	Floods----------	Favorable---------	Favorable.
Burson:					
[1]BQG:					
Burson part-----	Severe: depth to rock, seepage.	Severe: thin layer.	Rooting depth-----	Slope, depth to rock.	Slope, rooting depth.
Quinlan part----	Severe: depth to rock.	Severe: thin layer.	Droughty, slope, rooting depth.	Depth to rock, slope.	Droughty, slope, rooting depth.
Rock outcrop.					

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Clairemont:					
Cc	Moderate: seepage.	Moderate: piping,	Floods	Not needed	Not needed.
[1]Cm:					
Clairemont part	Moderate: seepage.	Moderate: piping, compressible.	Floods	Not needed	Not needed.
Mangum part	Slight	Moderate: shrink-swell, compressible.	Floods, slow intake.	Not needed	Not needed.
Ector:					
[1]ERE:					
Ector part	Severe: depth to rock.	Severe: thin layer.	Rooting depth	Depth to rock	Rooting depth.
Rock outcrop.					
Estacado:					
EsA, EsB, EsC	Moderate: seepage.	Moderate: seepage, low strength.	Erodes easily	Favorable	Favorable.
[1]Eu:					
Estacado part	Moderate: seepage.	Moderate: seepage, low strength.	Erodes easily	Favorable	Favorable.
Urban land.					
Knoco:					
[1]KBE:					
Knoco part	Slight	Moderate: low strength, shrink-swell.	Not needed	Not needed	Not needed.
Badland.					
Latom:					
[1]LAE:					
Latom part	Severe: depth to rock.	Severe: thin layer.	Rooting depth, droughty, slope.	Depth to rock, slope.	Rooting depth, slope, droughty.
Rock outcrop.					
Likes:					
LeD	Severe: seepage.	Severe: erodes easily, seepage, piping.	Erodes easily, fast intake.	Too sandy	Erodes easily.
Lincoln:					
[1]Lf	Severe: seepage.	Moderate: unstable fill, piping.	Seepage, fast intake.	Not needed	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Lipan: Lh	Slight	Moderate: compressible, unstable fill, shrink-swell.	Floods, slow intake.	Percs slowly	Percs slowly.
[1]Ln: Lipan part	Slight	Moderate: compressible, unstable fill, shrink-swell.	Floods, slow intake.	Percs slowly	Percs slowly.
Urban land.					
Lofton: Lo	Slight	Moderate: compressible, shrink-swell.	Slow intake	Not needed	Favorable.
Lofton: [1]Lu: Lofton part	Slight	Moderate: compressible.	Slow intake	Not needed	Favorable.
Urban land.					
Mangum: Ma	Slight	Moderate: shrink-swell, compressible.	Floods, slow intake.	Not needed	Not needed.
Mobeetie: MfB, MfC, MfD	Severe: seepage.	Moderate: piping, seepage.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
[1]Mo: Mobeetie part	Severe: seepage.	Moderate: piping, seepage.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Urban land.					
Mobeetie: [1]MTE: Mobeetie part	Severe: seepage.	Moderate: piping, seepage.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Tascosa part	Severe: seepage.	Moderate: piping.	Slope, droughty.	Slope	Slope, droughty.
[1]MVE: Mobeetie part	Severe: seepage.	Moderate: piping, seepage.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Veal part	Moderate: seepage.	Moderate: low strength, piping.	Complex slope, droughty, excess lime.	Erodes easily, slope.	Droughty, erodes easily, slope.
Olton: OcA, OcB	Moderate: seepage.	Moderate: piping.	Slow intake	Favorable	Favorable.
[1]Ou: Olton part	Moderate: seepage.	Moderate: piping.	Slow intake	Favorable	Favorable.
Urban land.					

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Paloduro: PaB, PaC, PaD----	Moderate: seepage.	Moderate: piping, erodes easily.	Favorable---------	Favorable---------	Favorable.
Posey: PcB, PcC, PcD----	Moderate: seepage.	Moderate: piping, seepage.	Slope, excess lime, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
[1]Pe: Posey part------	Moderate: seepage.	Moderate: piping, seepage.	Slope, excess lime, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Urban land.					
Potter: [1]PMG: Potter part-----	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
Mobeetie part---	Severe: seepage.	Moderate: piping, seepage.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Pullman: PuA, PuB---------	Slight----------	Moderate: shrink-swell, low strength.	Slow intake-------	Favorable---------	Favorable.
[1]Px: Pullman part----	Slight----------	Moderate: shrink-swell, low strength.	Slow intake, wetness.	Not needed--------	Not needed.
Urban land.					
Randall: Ra----------	Slight----------	Moderate: unstable fill, hard to pack, shrink-swell.	Slow intake, wetness.	Not needed--------	Not needed.
Tascosa: [1]TAF----------	Severe: seepage.	Moderate: piping.	Slope, droughty.	Slope----------	Slope, droughty.
Tivoli: Tf----------	Severe: seepage.	Severe: unstable fill, seepage, piping.	Complex slope, erodes easily, droughty.	Complex slope, erodes easily, fast intake.	Erodes easily, droughty, seepage.
[1]TSD: Tivoli part-----	Severe: seepage.	Severe: unstable fill, seepage, piping.	Complex slope, erodes easily, droughty.	Complex slope, erodes easily, fast intake.	Erodes easily, droughty, seepage.
Springer part---	Severe: seepage.	Moderate: seepage, piping.	Fast intake, erodes easily.	Too sandy, erodes easily.	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Veal:					
[1]VPD:					
Veal part-------	Moderate: seepage.	Moderate: low strength, piping.	Complex slope, droughty, excess lime.	Erodes easily, slope.	Droughty, erodes easily, slope.
Paloduro part---	Moderate: seepage.	Moderate: piping, erodes easily.	Favorable---------	Favorable---------	Favorable.
Vernon:					
[1]VWF:					
Vernon part-----	Slight----------	Moderate: compressible, low strength, shrink-swell.	Complex slope, percs slowly, droughty.	Complex slope, percs slowly.	Droughty, percs slowly, slope.
Owens part------	Slight----------	Moderate: compressible.	Droughty, percs slowly.	Slope, rooting depth.	Droughty, erodes easily.
Weymouth:					
WeB, WeC---------	Moderate: seepage.	Moderate: low strength, piping.	Slope, rooting depth.	Slope, piping, rooting depth.	Slope, rooting depth.
[1]WVD:					
Weymouth part---	Moderate: seepage.	Moderate: low strength, piping.	Slope, rooting depth.	Slope, piping, rooting depth.	Slope, rooting depth.
Vernon part-----	Slight----------	Moderate: compressible, low strength, shrink-swell.	Complex slope, percs slowly, droughty.	Complex slope, percs slowly.	Droughty, percs slowly, slope.
Yomont:					
[1]Yo------------	Severe: seepage.	Moderate: piping, unstable fill, seepage.	Floods, fast intake.	Not needed--------	Not needed.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 13.--POTENTIAL FOR URBANIZATION

Soil name and map symbol	Elements of urbanization					Major problems to overcome
	Dwellings	Streets	Excavations	Uncoated steel pipe	Potential for urbanization	
Acuff: AcA, AcB, AcC	Medium	Medium	High	Medium	High	Low strength.
Amarillo: AfB, Am	High	High	High	Medium	High	Risk of corrosion.
Aspermont: [1]APD	Medium	Medium	Low	Medium	Medium	Slope.
[1]AQF	Low	Low	Low	Medium	Medium	Slope.
Bippus: BcA, [1]Bd	Very low	Very low	Very low	Medium	Very low	Flooding.
BcB	Medium	Medium	High	Medium	Medium	Low strength.
Burson: [1]BQG	Very low	Very low	Low	High	Very low	Slope.
Clairemont: Cc, [1]Cm	Low	Low	Low	Medium	Very low	Flooding.
Ector: [1]ERE	Very low	Very low	Low	Low	Very low	Depth to rock.
Enterprise: [1]APD	Medium	Medium	High	High	Medium	Slope.
Estacado: EsA, EsB, EsC, Eu	High	High	High	Medium	High	Risk of corrosion.
Knoco: [1]KBE	Very low	Very low	Very low	Low	Very low	Slope, shrink-swell.
Latom: [1]LAE	Low	Low	Low	High	Low	Depth to rock.
Likes: LeD	High	High	Low	High	High	Slope, sandy texture.
Lincoln: Lf	Very low	Very low	Very low	Low	Very low	Flooding.
Lipan: Lh, Ln	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell.
Lofton: Lo, Lu	Low	Low	Low	Low	Low	Shrink-swell.
Mangum: Ma, [1]Cm	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell.
Mobeetie: MfB, MfC, MfD, Mo	High	High	High	High	High	None.
[1]MTE, [1]MVE	High	High	High	High	High	Slope.
Olton: OcA, OcB, Ou	Medium	Low	Medium	Medium	Medium	Low strength, shrink-swell.
Owens: [1]VWF	Low	Low	Low	Low	Low	Slope, shrink-swell.
Paloduro: PaB, PaC, PaD, [1]VPD	High	High	High	Medium	High	Low strength.

See footnote at end of table.

TABLE 13.--POTENTIAL FOR URBANIZATION--Continued

Soil name and map symbol	Elements of urbanization					Major problems to overcome
	Dwellings	Streets	Excavations	Uncoated steel pipe	Potential for urbanization	
Posey: PcB, PcC, PcD, Pe--	High	High	High	Medium	High	Risk of corrosion.
Potter: [1]PMG	Very low	Very low	Medium	Medium	Very low	Slope, depth to rock.
Pullman: PuA, PuB, Px	Low	Low	Low	Low	Low	Shrink-swell, low strength, risk of corrosion.
Quinlan: [1]AQF	Low	Low	Medium	High	Low	Slope, depth to rock.
Randall: Ra	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell.
Springer: [1]TSD	High	High	High	Low	High	Sandy texture.
Spur: [1]Bd	Very low	Very low	Very low	Medium	Very low	Flooding.
Tascosa: [1]TAF, [1]MTE	Low	Low	Low	High	Low	Slope, small stones.
Tivoli: [1]Tf, [1]TSD	High	High	Low	High	High	Sandy texture.
Veal: [1]VPD, [1]MVE	High	Medium	High	Medium	High	Slope, low strength.
Vernon: [1]VWF, [1]WVD	Low	Low	Low	Low	Low	Shrink-swell, low strength.
Weymouth: WeB, WeC	Medium	Medium	Medium	Medium	Medium	Risk of corrosion, low strength.
[1]WVD	Medium	Medium	Medium	Medium	Medium	Slope, low strength.
Yomont: Yo	Very low	Very low	Very low	High	Very low	Flooding.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the map unit.

TABLE 14.--SELECTED PLANTS FOR SOILS OF POTTER COUNTY

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Acuff: AcA, AcB, AcC	Chrysanthemum, canna, marigold, dahlia, gladiolus, creeping phlox, bugle.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper, clematis, trumpetvine.	Nandina, Japanese snowball, lantana, pyracantha, bridalwreath, lilac, roses, arborvitae.	Redbud, fruitless mulberry, mimosa, elm, green ash, pecan, Russian-olive, cottonwood.
Amarillo: AfB, [1]Am	Chrysanthemum, dahlia, creeping phlox, cottage pinks, marigold, canna.	English ivy, morning-glory, wisteria, Halls honeysuckle, grape, Virginia creeper, clematis.	Nandina, Japanese snowball, lantana, pyracantha, bridalwreath, lilac, roses, arborvitae.	Redbud, fruitless mulberry, mimosa, elm, green ash, pecan, Russian-olive, cottonwood.
Aspermont: [1]APD, [1]AQF	Chrysanthemum, cottage pinks, marigold, petunia, zinnia, shasta, daisy, iris, dahlia.	Halls honeysuckle, Virginia creeper, purple wisteria, morningglory, English ivy, clematis.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Honeylocust, elm, Russian-olive, hackberry, cottonwood, fruitless mulberry, blue spruce, Arizona cypress.
Bippus: BcA, BcB, [1]Bd	Gladiolus, iris, dahlia, cottage pinks, shasta daisy, hollyhocks, marigold, chrysanthemum.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, Virginia creeper, clematis.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Cottonwood, fruitless mulberry, hackberrry, Russian-olive, elm, honeylocust, Arizona cypress, willows.
Burson: [1]BQG	(2)	(2)	(2)	(2).
Clairemont: Cc, [1]Cm	Chrysanthemum, dahlia, cottage pinks, marigold, petunia, zinnia, iris, shasta daisy.	Halls honeysuckle, Virginia creeper, purple wisteria, morningglory, English ivy, clematis.	Nandina, juniper, lilac, privet, aborvitae, bridalwreath.	Honeylocust, elm, Russian-olive, hackberry, cottonwood, fruitless mulberry.
Ector: [1]ERE	(2)	(2)	(2)	(2).
Enterprise: [1]APD	(2)	(2)	(2)	(2).
Estacado: EsA, EsB, EsC, [1]Eu	Chrysanthemum, cottage pinks, marigold, petunia, zinnia, shasta daisy, hollyhocks, iris.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, Virginia creeper, clematis.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Honeylocust, elm, Arizona cypress, blue spruce, fruitless mulberry, Russian-olive, hackberry.
Knoco: [1]KBE	(2)	(2)	(2)	(2).
Latom: [1]LAE	(2)	(2)	(2)	(2).

See footnotes at end of table.

TABLE 14.--SELECTED PLANTS FOR SOILS OF POTTER COUNTY--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Likes: LeD	Chrysanthemum, creeping phlox, dahlia, zinnia, cottage pinks, marigold, canna, gladiolus.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper, trumpetvine.	Viburnums, nandina, pyracantha, bridalwreath, crapemyrtle, juniper, photinia, roses.	Redbud, fruitless mulberry, mimosa, pecan, ponderosa pine, green ash, elm, Arizona cypress.
Lincoln: [1]Lf	Chrysanthemum, creeping phlox, dahlia, zinnia, cottage pinks, marigold, canna, gladiolus.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper, trumpetvine.	Viburnums, nandina, lantana, pyracantha, bridalwreath, crapemyrtle, juniper photinia.	Redbud, fruitless mulberry, mimosa, pecan, green ash, weeping willow, Russian-olive.
Lipan: Lh, [1]Ln	Canna, zinnia, gladiolus, petunia, shasta daisy, bugle.	English ivy, morning-glory, purple wisteria, clematis, Halls honeysuckle.	Bridalwreath, pyracantha, mockorange, arborvitae, juniper, golden elder.	Elm, honeylocust, Russian-olive, cottonwood, silver maple, willows.
Lofton: Lo, [1]Lu	Chrysanthemum, cottage pinks, marigold, canna, dahlia, creeping phlox, gladiolus, petunia.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper.	Nandina, pyracantha, bridalwreath, juniper, arborvitae, crapemyrtle, lilac, roses.	Redbud, fruitless mulberry, mimosa, elm, green ash, honeylocust, Russian-olive, sycamore.
Mangum: Ma, [1]Cm	Canna, zinnia, gladiolus, petunia, shasta daisy, bugle.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, clematis.	Bridalwreath, juniper, arborvitae, mockorange, pyracantha.	Elm, honeylocust, Russian-olive, cottonwood, willows.
Mobeetie: MfB, MfC, MfD, [1]Mo, [1]MTE, [1]MVE, [1]PMG.	Chrysanthemum, cottage pinks, marigold, canna, petunia, zinnia, creeping phlox.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper, trumpetvine.	Nandina, photinia, pyracantha, bridalwreath, crapemyrtle, juniper, arborvitae, roses.	Redbud, fruitless mulberry, mimosa, pecan, green ash, elm, Arizona cypress, ponderosa pine.
Olton: OcA, OcB, [1]Ou	Chrysanthemum, cottage pinks, marigold, canna, dahlia, creeping phlox, bugle, gladiolus.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper, trumpetvine.	Japanese snowball, forsythia, lilac, roses, pyracantha, nandina, bridalwreath, crapemyrtle.	Sycamore, Arizona cypress, pecan, cottonwood, mimosa, elm, redbud, green ash.
Owens: [1]VWF	(2)	(2)	(2)	(2).
Paloduro: PaB, PaC, PaD, [1]VPD	Chrysanthemum, cottage pinks, marigold, petunia, zinnia, shasta daisy, hollyhocks, iris.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, Virginia creeper, clematis.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Redbud, fruitless mulberry, mimosa, elm, green ash, honeylocust, blue spruce.

See footnotes at end of table.

TABLE 14.--SELECTED PLANTS FOR SOILS OF POTTER COUNTY--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Posey: PcB, PcC, PcD, [1]Pe	Hollyhocks, iris, dahlia, shasta daisy, petunia, zinnia, cottage pinks.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, Virginia creeper, clematis.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Honeylocust, elm, Arizona cypress, fruitless mulberry, blue spruce, hackberry.
Potter: [1]PMG	(2)	(2)	(2)	(2).
Pullman: PuA, PuB, [1]Px	Chrysanthemum, cottage pinks, dahlia, marigold, canna, creeping phlox, petunia, zinnia.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, grape, Virginia creeper, trumpetvine.	Japanese snowball, forsythia, lilac, roses, pyracantha, nandina, bridalwreath, crape-myrtle.	Sycamore, Arizona cypress, pecan, cottonwood, mimosa, elm, redbud, green-ash.
Randall: Ra	Canna, zinnia, gladiolus, petunia, shasta daisy, bugle.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, clematis.	Bridalwreath, juniper, pyracantha, mockorange, arborvitae, golden elder.	Elm, honeylocust, willows, cottonwood, Russian-olive, silver maple.
Springer: [1]TsD	Chrysanthemum, cottage pinks, marigold, canna, petunia, creeping phlox, dahlia, gladiolus.	English ivy, Virginia creeper, trumpetvine, grape, purple wisteria, Halls honeysuckle.	Nandina, pyracantha, bridalwreath, crape-myrtle, juniper, roses, arborvitae, photinia.	Redbud, elm, fruitless mulberry, Arizona cypress, cottonwood, pecan, ponderosa pine.
Spur: [1]Bd	Gladiolus, iris, dahlia, cottage pinks, shasta daisy, hollyhocks, marigold, chrysanthemum.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, Virginia creeper, clematis.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Cottonwood, fruitless mulberry, hackberry, elm, willows, honeylocust.
Tascosa: [1]TAF, [1]MTE,	(2)	(2)	(2)	(2).
Tivoli: Tf, [1]TSD	Chrysanthemum, cottage pinks, marigold, canna, petunia, creeping phlox, dahlia, gladiolus.	English ivy, Virginia creeper, trumpetvine, grape, purple wisteria, Halls honeysuckle.	Nandina, pyracantha, bridalwreath, crape-myrtle, juniper, arborvitae, roses, photinia.	Redbud, fruitless mulberry, elm, Arizona cypress, cottonwood, pecan, ponderosa pine.
Veal: [1]MVE, [1]VPD	Iris, dahlia, hollyhocks, shasta daisy, zinnia, petunia.	Morningglory, English ivy, purple wisteria, Halls honeysuckle, clematis.	Juniper, privet, lilac, nandina, arborvitae.	Honeylocust, Arizona cypress, blue spruce, elm, Russian-olive.

See footnotes at end of table.

TABLE 14.--SELECTED PLANTS FOR SOILS OF POTTER COUNTY--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Vernon: [1]VWF, [1]WVD	(2)	(2)	(2)	(2).
Weymouth: WeB, WeC, [1]WVD	Chrysanthemum, iris, dahlis, cottage pinks, marigold, hollyhocks, shasta daisy.	English ivy, morning-glory, purple wisteria, Halls honeysuckle, Virginia creeper.	Nandina, juniper, lilac, privet, arborvitae, bridalwreath.	Honeylocust, elm, hackberry, fruitless mulberry, Arizona cypress, blue spruce.
Yomont: Yo	Chrysanthemum, iris, cottage pinks, canna, dahlia, zinnia, petunia.	Morningglory, English ivy, purple wisteria, grape, Halls honeysuckle, trumpetvine.	Nandina, pyracantha, bridalwreath, crape-myrtle, juniper, roses, photinia.	Willows, elm, green ash, mimosa, fruitless mulberry, pecan.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the map unit.

[2]No flowers and ground cover, vines, shrubs, or trees suggested.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Acuff:											
AcA, AcB, AcC-----	0-11	Loam----------	CL	A-4, A-6	0	100	95-100	95-100	51-70	24-32	10-16
	11-52	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	95-100	65-75	28-45	12-25
	52-80	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-75	25-42	12-25
Amarillo:											
AfB----------	0-9	Fine sandy loam	SM, SM-SC, CL-ML	A-2-4, A-4	0	100	100	95-100	35-55	17-25	3-7
	9-38	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4	0	100	100	95-100	35-65	20-40	7-20
	38-80	Sandy clay loam, clay loam.	SC, CL, SM-SC	A-4, A-6, A-2-4	0	90-100	90-100	65-98	35-70	20-35	7-17
[1]Am:											
Amarillo part----	0-9	Fine sandy loam.	SM, SM-SC, CL-ML	A-2-4, A-4	0	100	100	95-100	35-55	17-25	3-7
	9-38	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4	0	100	100	95-100	35-65	20-40	7-20
	38-80	Sandy clay loam, clay loam.	SC, CL, SM-SC	A-4, A-6, A-2-4	0	90-100	90-100	65-98	35-70	20-35	7-17
Urban land.											
Aspermont:											
[1]APD:											
Aspermont part---	0-50	Silty clay loam	CL	A-7-6, A-6	0	100	98-100	90-100	51-90	30-45	12-28
	50-80	Loam, silty clay loam, clay loam.	CL	A-7-6, A-6	0	100	95-100	80-98	51-95	30-45	12-28
Enterprise part--	0-70	Very fine sandy loam.	CL-ML, ML, CL	A-4, A-6	0	100	98-100	90-100	55-90	20-32	3-12
[1]AQF:											
Aspermont part---	0-50	Silty clay loam	CL	A-7-6, A-6	0	100	98-100	90-100	51-90	30-45	12-28
	50-80	Loam, silty clay loam, clay loam.	CL	A-7-6, A-6	0	100	95-100	80-98	51-95	30-45	12-28
Quinlan part-----	0-14	Very fine sandy loam.	SM, ML, CL	A-4	0	100	95-100	90-100	36-75	<30	NP-9
	14-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Bippus:											
BcA, BcB----------	0-7	Clay loam-------	CL, SC, SM-SC	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	7-80	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20
[1]Bd:											
Bippus part------	0-7	Clay loam-------	CL, SC, SM-SC	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	7-80	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20

See footnote at end of page.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Bippus:											
Spur part--------	0-18	Clay loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	51-95	25-45	7-25
	18-80	Loam, clay loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	100	95-100	90-100	45-95	22-45	7-25
Burson:											
[1]BQG:											
Burson part------	0-6	Loam------------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	50-85	18-30	3-12
	6-60	Weathered bedrock, variable.	---	---	---	---	---	---	---	---	---
Quinlan part-----	0-14	Very fine sandy loam.	SM, ML, CL	A-4	0	100	95-100	90-100	36-75	<30	NP-9
	14-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Clairemont:											
Cc----------------	0-60	Silty clay loam	CL, ML, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	25-40	7-20
[1]Cm:											
Clairemont part--	0-60	Silty clay loam	CL, ML, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	25-40	7-20
Mangum part------	0-22	Clay------------	CL, CH	A-7-6, A-6	0	100	100	98-100	90-100	40-70	22-45
	22-60	Clay, silty clay	CL, CH	A-7-6, A-6	0	100	100	95-100	80-100	40-70	22-45
Ector:											
[1]ERE:											
Ector part-------	0-11	Very gravelly loam.	GC, SC	A-2-4, A-2-6	5-45	30-70	20-65	15-50	13-35	25-35	8-15
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Estacado:											
EsA, EsB, EsC-----	0-12	Clay loam-------	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	12-27	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	27-80	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
[1]Eu:											
Estacado part----	0-12	Clay loam-------	CL	A-6, A-4	0	95-100	95-100	55-90	51-90	25-40	8-20
	12-27	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	27-80	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
Urban land.											
Knoco:											
[1]KBE:											
Knoco part-------	0-5	Clay------------	CL, CH	A-7-6, A-6	0-5	90-100	90-100	90-100	80-98	32-60	14-38
	5-52	Weathered bedrock breaks to shaly clay.	CL, CH	A-7-6, A-6	0-5	90-100	85-100	60-100	60-95	30-60	13-38
Badland.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Latom:											
[1]LAE:											
Latom part-------	0-10	Fine sandy loam	SM, SM-SC	A-4, A-2-4	0-5	80-100	75-98	70-90	25-45	<25	NP-7
	10-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Likes:											
LeD----------	0-60	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4	0-2	90-100	90-98	75-95	10-30	<25	NP-5
Lincoln:											
[1]Lf----------	0-9	Loamy fine sand	SM, SM-SP	A-2, A-3	0	90-100	85-100	75-100	8-35	---	NP
	9-60	Fine sand, loamy fine sand.	SM, SM-SP	A-2, A-3	0	90-100	85-100	75-100	8-35	---	NP
Lipan:											
Lh----------	0-50	Clay----------	CH	A-7-6	0-15	85-100	80-100	80-100	80-95	55-75	32-49
	50-60	Clay, silty clay	CH	A-7-6	0-15	85-100	80-100	80-100	70-95	46-66	25-40
[1]Ln:											
Lipan part-------	0-50	Clay----------	CH	A-7-6	0-15	85-100	80-100	80-100	80-95	55-75	32-49
	50-60	Clay, silty clay.	CH	A-7-6	0-15	85-100	80-100	80-100	70-95	46-66	25-40
Urban land.											
Lofton:											
Lo----------	0-8	Clay loam-------	CL	A-6, A-7	0	100	100	98-100	70-90	35-45	15-25
	8-42	Clay, silty clay	CL	A-6, A-7	0	100	100	95-100	70-90	38-50	20-30
	42-60	Clay, silty clay, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	60-80	30-45	15-25
Lofton:											
[1]Lu:											
Lofton part------	0-8	Clay loam-------	CL	A-6, A-7	0	100	100	98-100	70-90	35-45	15-25
	8-42	Clay, silty clay	CL	A-6, A-7	0	100	100	95-100	70-90	38-50	20-30
	42-60	Clay, silty clay, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	60-80	30-45	15-25
Urban land.											
Mangum:											
Ma----------	0-22	Clay----------	CL, CH	A-7-6, A-6	0	100	100	98-100	90-100	40-70	22-45
	22-60	Clay, silty clay	CL, CH	A-7-6, A-6	0	100	100	95-100	80-100	40-70	22-45
Mobeetie:											
MfB, MfC, MfD-----	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
[1]Mo:											
Mobeetie part----	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Urban land.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
[1]Mo:											
Mobeetie part----	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Tascosa part-----	0-10	Gravelly loam---	SM, GM, GM-GC, GC	A-1, A-2	0-5	40-65	35-60	25-50	10-26	25-42	5-14
	10-28	Very gravelly loam, very gravelly sandy loam.	SM, GM, GM-GC, GC	A-1	0-5	28-60	20-50	15-45	8-25	25-40	5-14
	28-45	Very gravelly sandy loam, very gravelly loam, gravelly sandy loam.	GM, SM, GC, GM-GC	A-1	0-5	30-60	30-60	15-45	5-15	<32	NP-14
[1]MVE:											
Mobeetie part----	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Veal part--------	0-6	Loam-----------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	90-100	85-100	70-98	36-75	20-35	5-17
	6-14	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	80-100	40-80	22-40	7-20
	14-60	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	65-100	35-80	22-40	7-20
Olton:											
OcA, OcB----------	0-10	Clay loam-------	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-35	8-18
	10-55	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	55-80	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-85	20-40	8-25
Ou:											
Olton part-------	0-10	Clay loam-------	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-35	8-18
	10-55	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	55-80	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-85	20-40	8-25
Urban land.											
Paloduro:											
PaB, PaC, PaD-----	0-12	Clay loam-------	CL, SC	A-4, A-6	0	95-100	95-100	80-95	40-75	20-35	8-20
	12-80	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-95	40-75	20-35	8-20
Posey:											
PcB, PcC, PcD-----	0-7	Clay loam-------	CL, SC, SM-SC, CL-ML	A-4, A-6	0	98-100	95-100	85-100	36-80	20-35	5-15
	7-60	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	80-100	45-80	22-40	7-22
	60-80	Sandy clay loam, clay loam.	CL	A-4, A-6	0	85-100	85-100	80-100	51-75	25-40	8-22

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Pe:											
Posey part------	0-7	Clay loam-------	CL, SC SM-SC, CL-ML	A-4, A-6	0	98-100	95-100	85-100	36-80	20-35	5-15
	7-60	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	80-100	45-80	22-40	7-22
	60-80	Sandy clay loam, clay loam.	CL	A-4, A-6	0	85-100	85-100	80-100	51-75	25-40	8-22
Urban land.											
Potter:											
[1]PMG:											
Potter part------	0-9	Gravelly loam---	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	9-60	Variable--------	GM, GC, SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Mobeetie part----	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Pullman:											
PuA, PuB----------	0-7	Clay loam-------	CL	A-6, A-7-6	0	100	100	95-100	70-90	30-50	15-30
	7-54	Clay, silty clay.	CL, CH	A-7-6	0	100	100	95-100	85-98	41-55	22-35
	54-80	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	95-100	90-100	80-100	75-95	30-50	15-30
Px:											
Pullman part-----	0-7	Clay------------	CL	A-6, A-7-6	0	100	100	95-100	70-90	30-50	15-30
	7-54	Clay, silty clay.	CL, CH	A-7-6	0	100	100	95-100	85-98	41-55	22-35
	54-80	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	95-100	90-100	80-100	75-95	30-50	15-30
Urban land.											
Randall:											
Ra----------	0-66	Clay------------	CL, CH	A-7-6	0	100	100	95-100	75-98	41-70	22-45
Tascosa:											
[1]TAF----------	0-10	Gravelly loam---	SM, GM, GM-GC, GC	A-1, A-2	0-5	40-65	35-60	25-50	10-26	25-42	5-14
	10-28	Very gravelly loam, very gravelly sandy loam.	SM, GM, GM-GC, GC	A-1	0-5	28-60	20-50	15-45	8-25	25-40	5-14
	28-45	Very gravelly sandy loam, very gravelly loam, gravelly sandy loam.	GM, SM, GC, GM-GC	A-1	0-5	30-60	30-60	15-45	5-15	<32	NP-14
Tivoli:											
Tf----------	0-5	Fine sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	80-100	5-35	---	NP
	5-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	98-100	80-98	5-20	---	NP
[1]TSD:											
Tivoli part------	0-5	Fine sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	80-100	5-35	---	NP
	5-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	98-100	80-98	5-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Tivoli:											
Springer part----	0-10	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	10-42	Fine sandy loam	SM, SM-SC	A-2-4	0	98-100	95-100	75-99	11-35	18-25	2-7
	42-63	Loamy fine sand	SP-SM, SM-SC	A-3							
	63-80	Fine sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2-4, A-4	0	98-100	95-100	75-99	11-45	18-25	2-8
Veal:											
[1]VPD:											
Veal part--------	0-6	Loam----------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	90-100	85-100	70-98	36-75	20-35	5-17
	6-14	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	80-100	40-80	22-40	7-20
	14-60	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	65-100	35-80	22-40	7-20
Paloduro part----	0-12	Clay loam-------	CL, SC	A-4, A-6	0	95-100	95-100	80-95	40-75	20-35	8-20
	12-80	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-95	40-75	20-35	8-20
Vernon:											
[1]VWF:											
Vernon part------	0-38	Clay----------	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	38-60	Weathered bedrock breaks to shaly clay or shaly silty clay.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-95	30-60	15-38
Owens part-------	0-13	Clay----------	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
	13-60	Weathered bedrock breaks to shaly clay.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	55-95	40-55	25-35
Weymouth:											
WeB, WeC----------	0-9	Clay loam-------	CL	A-6, A-7-6	0	95-100	90-100	80-100	65-90	30-42	12-25
	9-38	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	80-100	75-100	70-98	65-92	30-42	12-25
	38-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[1]WVD:											
Weymouth part----	0-9	Clay loam-------	CL	A-6, A-7-6	0	95-100	90-100	80-100	65-90	30-42	12-25
	9-38	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	80-100	75-100	70-98	65-92	30-42	12-25
	38-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Weymouth:											
Vernon part------	0-38	Clay----------	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	38-60	Shaly clay------	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-95	30-60	15-38

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Yomont: [1]Yo----------	0-60	Very fine sandy loam, loam, silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	98-100	90-100	51-85	<30	NP-12

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Acuff:										
AcA, AcB, AcC-----	0-11	0.6-2.0	0.12-0.18	6.6-7.8	Low-------	Moderate	Low------	0.28	5	5
	11-52	0.6-2.0	0.14-0.19	7.4-8.4	Low-------	Moderate	Low------	0.32		
	52-80	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.32		
Amarillo:										
AfB----------	0-9	2.0-6.0	0.11-0.15	6.6-7.8	Low-------	Low------	Low------	0.24	5	3
	9-38	0.6-2.0	0.14-0.18	7.4-8.4	Low-------	Moderate	Low------	0.32		
	38-80	0.6-2.0	0.10-0.15	7.9-8.4	Low-------	Moderate	Low------	0.32		
Am:										
Amarillo part---	0-9	2.0-6.0	0.11-0.15	6.6-7.8	Low-------	Low------	Low------	0.24	5	3
	9-38	0.6-2.0	0.14-0.18	7.4-8.4	Low-------	Moderate	Low------	0.32		
	38-80	0.6-2.0	0.14-0.15	7.9-8.4	Low-------	Moderate	Low------	0.32		
Urban land.										
Aspermont:										
[1]APD:										
Aspermont part---	0-50	0.6-2.0	0.16-0.22	7.9-8.4	Moderate	Moderate	Low------	0.32	4	4L
	50-80	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	Moderate	Low------	0.32		
Enterprise part--	0-70	2.0-6.0	0.15-0.20	7.4-8.4	Low-------	Low------	Low------	0.43	5	3
[1]AQF:										
Aspermont part---	0-50	0.6-2.0	0.16-0.22	7.9-8.4	Moderate	Moderate	Low------	0.32	4	4L
	50-80	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	Moderate	Low------	0.32		
Quinlan part-----	0-14	2.0-6.0	0.07-0.11	7.4-8.4	Low-------	Low------	Low------	0.28	2	4L
	14-40	---	---	---	----------	---------	---------	---		
Bippus:										
BcA, BcB----------	0-7	0.6-2.0	0.14-0.20	7.4-8.4	Moderate	Moderate	Low------	0.28	5	6
	7-80	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low------	0.28		
[1]Bd:										
Bippus part------	0-7	0.6-2.0	0.14-0.20	7.4-8.4	Moderate	Moderate	Low------	0.28	5	6
	7-80	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low------	0.28		
Spur part--------	0-18	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low------	0.28	5	6
	18-80	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low------	0.28		
Burson:										
[1]BQG:										
Burson part------	0-6	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Low------	Low------	0.43	1	7
	6-60	---	---	---	----------	---------	---------	---		
Quinlan part-----	0-14	2.0-6.0	0.07-0.11	7.4-8.4	Low-------	Low------	Low------	0.28	2	4L
	14-40	---	---	---	----------	---------	---------	---		
Rock outcrop.										
Clairemont:										
Cc----------	0-60	0.6-2.0	0.16-0.22	7.9-8.4	Low-------	Moderate	Low------	0.43	5	6
[1]Cm:										
Clairemont part--	0-60	0.6-2.0	0.16-0.22	7.9-8.4	Low-------	Moderate	Low------	0.43	5	6
Mangum part------	0-22	<0.06	0.14-0.18	7.9-8.4	High------	High-----	Low------	0.32	5	4
	22-60	<0.06	0.14-0.18	7.9-8.4	High------	High-----	Low------	0.32		
Ector:										
[1]ERE:										
Ector part-------	0-11	0.6-2.0	0.05-0.12	7.9-8.4	Very low	High-----	Low------	0.28	1	7
	11-60	---	---	---	----------	---------	---------	---		
Rock outcrop.										

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Estacado:										
EsA, EsB, EsC-----	0-12	0.6-2.0	0.14-0.19	7.9-8.4	Low-------	Moderate	Low------	0.28	5	4L
	12-27	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
	27-80	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
[1]Eu:										
Estacado part---	0-12	0.6-2.0	0.14-0.19	7.9-8.4	Low-------	Moderate	Low------	0.28	5	4L
	12-27	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
	27-80	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
Urban land.										
Knoco:										
[1]KBE:										
Knoco part-------	0-5	<0.06	0.10-0.17	7.9-8.4	High------	High-----	Low------	0.32	1	7
	5-52	<0.06	0.00-0.08	7.9-8.4	High------	High-----	Low------	---		
Badland.										
Latom:										
[1]LAE:										
Latom part-------	0-10	0.6-2.0	0.10-0.15	7.9-8.4	Low-------	Low------	Low------	0.24	1	3
	10-60	---	---	---	----------	---------	---------	---		
Rock outcrop.										
Likes:										
LeD----------	0-60	2.0-6.0	0.04-0.10	7.4-8.4	Very low	Low------	Low------	0.15	5	2
Lincoln:										
[1]Lf----------	0-9	6.0-20.0	0.05-0.10	7.4-8.4	Low-------	Low------	Low------	0.17	5	2
	9-60	6.0-20.0	0.05-0.10	7.9-8.4	Low-------	Low------	Low------	0.17		
Lipan:										
Lh----------	0-50	<0.06	0.13-0.18	7.4-8.4	Very high	High-----	Low------	0.32	5	4
	50-60	<0.06	0.13-0.18	7.9-8.4	Very high	High-----	Low------	0.32		
[1]Ln:										
Lipan part-------	0-50	<0.06	0.13-0.18	7.4-8.4	Very high	High-----	Low------	0.32	5	4
	50-60	<0.06	0.13-0.18	7.9-8.4	Very high	High-----	Low------	0.32		
Urban land.										
Lofton:										
Lo----------	0-8	0.2-.60	0.16-0.20	6.6-8.4	Moderate	High-----	Low------	0.32	5	6
	8-42	<0.06	0.16-0.20	7.4-8.4	High------	High-----	Low------	0.32		
	42-60	.06-.20	0.12-0.16	7.9-8.4	Moderate	High-----	Low------	0.32		
Lofton:										
[1]Lu:										
Lofton part------	0-8	0.2-.60	0.16-0.20	6.6-8.4	Moderate	High-----	Low------	---	---	6
	8-42	<0.06	0.16-0.20	7.4-8.4	High------	High-----	Low------	---		
	42-60	.06-.20	0.12-0.16	7.9-8.4	Moderate	High-----	Low------	---		
Urban land.										
Mangum:										
Ma----------	0-22	<0.06	0.14-0.18	7.9-8.4	High------	High-----	Low------	0.32	5	4
	22-60	<0.06	0.14-0.18	7.9-8.4	High------	High-----	Low------	0.32		
Mobeetie:										
MfB, MfC, MfD-----	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low-------	Low------	Low------	0.24	3	3
[1]Mo:										
Mobeetie part---	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low-------	Low------	Low------	0.24	3	3
Urban land.										

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Mobeetie:										
[1]MTE:										
Mobeetie part----	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low-------	Low------	Low------	0.24	3	3
Tascosa part-----	0-10	.60-2.0	0.06-0.12	7.9-8.4	Very low	Low------	Low------	0.10	4	7
	10-28	.60-2.0	0.05-0.10	7.9-8.4	Very low	Low------	Low------	0.10		
	28-45	2.0-6.0	0.03-0.07	7.9-8.4	Very low	Low------	Low------	0.10		
[1]MVE:										
Mobeetie part----	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low-------	Low------	Low------	0.24	3	3
Veal part--------	0-6	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28	4	4L
	6-14	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28		
	14-60	0.6-2.0	0.10-0.15	7.9-8.4	Low-------	Moderate	Low------	0.28		
Olton:										
OcA, OcB----------	0-10	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low------	0.32	5	6
	10-55	0.2-0.6	0.14-0.19	7.4-8.4	Moderate	Moderate	Low------	0.37		
	55-80	0.2-0.6	0.10-0.16	7.9-8.4	Moderate	Moderate	Low------	0.37		
[1]Ou:										
Olton part-------	0-10	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low------	0.32	5	6
	10-55	0.2-0.6	0.14-0.19	7.4-8.4	Moderate	Moderate	Low------	0.37		
	55-80	0.2-0.6	0.10-0.16	7.9-8.4	Moderate	Moderate	Low------	0.37		
Urban land.										
Paloduro:										
PaB, PaC, PaD-----	0-12	0.6-2.0	0.15-0.20	7.9-8.4	Low-------	Moderate	Low------	0.28	5	5
	12-80	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28		
Posey:										
PcB, PcC, PcD-----	0-7	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28	3	4L
	7-60	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.32		
	60-80	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
[1]Pe:										
Posey part-------	0-7	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28	3	4L
	7-60	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.32		
	60-80	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
Urban land.										
Potter:										
[1]PMG:										
Potter part------	0-9	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.28	1	7
	9-60	0.6-6.0	0.00-0.06	7.9-8.4	Low-------	Moderate	Low------	---		
Mobeetie part----	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low-------	Low------	Low------	0.24	3	3
Pullman:										
PuA, PuB----------	0-7	0.2-0.6	0.14-0.19	6.6-8.4	Moderate	High-----	Low------	0.32	5	6
	7-54	<0.06	0.12-0.17	7.4-8.4	High------	High-----	Low------	0.37		
	54-80	0.06-0.2	0.10-0.16	7.9-8.4	Moderate	High-----	Low------	0.37		
[1]Px:										
Pullman part-----	0-7	0.2-0.6	0.14-0.19	6.6-8.4	Moderate	High-----	Low------	0.32	5	6
	7-54	<0.06	0.12-0.17	7.4-8.4	High------	High-----	Low------	0.37		
	54-80	0.06-0.2	0.10-0.16	7.9-8.4	Moderate	High-----	Low------	0.37		
Urban land.										
Randall:										
Ra----------	0-66	<0.06	0.12-0.18	7.4-8.4	Very high	High-----	Low------	0.32	5	4
Tascosa:										
[1]TAF----------	0-10	.60-2.0	0.06-0.12	7.9-8.4	Very low	Low------	Low------	0.10	4	7
	10-28	.60-2.0	0.05-0.10	7.9-8.4	Very low	Low------	Low------	0.10		
	28-45	2.0-6.0	0.03-0.07	7.9-8.4	Very low	Low------	Low------	0.10		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Tivoli:										
Tf	0-5	6.0-20.0	0.05-0.11	6.1-7.8	Low	Low	Low	0.17	5	1
	5-60	6.0-20.0	0.02-0.06	6.1-8.4	Low	Low	Low	0.17		
[1]TSD:										
Tivoli part	0-5	6.0-20.0	0.05-0.11	6.1-7.8	Low	Low	Low	0.17	5	1
	5-60	6.0-20.0	0.02-0.06	6.1-8.4	Low	Low	Low	0.17		
Springer part	0-10	6.0-20.0	0.06-0.10	6.6-7.8	Very low	Low	Low	0.17	5	2
	10-42	2.0-6.0	0.10-0.15	6.6-8.4	Low	Low	Low	0.20		
	42-63	6.0-20.0	0.06-0.10	6.6-8.4	Very low	Low	Low	0.20		
	63-80	0.6-6.0	0.10-0.16	6.6-8.4	Low	Low	Low	0.20		
Urban land:										
Ub.										
Veal:										
[1]VPD:										
Veal part	0-6	0.6-2.0	0.12-0.18	7.9-8.4	Low	Moderate	Low	0.28	4	4L
	6-14	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.28		
	14-60	0.6-2.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.28		
Paloduro part	0-12	0.6-2.0	0.15-0.20	7.9-8.4	Low	Moderate	Low	0.28	5	5
	12-80	0.6-2.0	0.12-0.18	7.9-8.4	Low	Moderate	Low	0.28		
Vernon:										
[1]VWF:										
Vernon part	0-38	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.37	2	6
	38-60	<0.06	0.00-0.10	7.9-8.4	High	High	Low	---		
Owens part	0-13	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37	1	6
	13-60	<0.06	0.03-0.08	7.9-8.4	High	High	Low	0.37		
Weymouth:										
WeB, WeC	0-9	0.6-2.0	0.16-0.20	7.9-8.4	Low	Moderate	Low	0.32	3	4L
	9-38	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.32		
	38-80	---	---	---	---	---	---	---		
[1]WVD:										
Weymouth part	0-9	0.6-2.0	0.16-0.20	7.9-8.4	Low	Moderate	Low	0.32	3	4L
	9-38	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.32		
	38-80	---	---	---	---	---	---	---		
Weymouth:										
Vernon part	0-38	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.37	2	6
	38-60	<0.06	0.00-0.10	7.9-8.4	High	High	Low	---		
Yomont:										
[1]Yo	0-60	2.0-6.0	0.16-0.22	7.9-8.4	Low	Low	Low	0.49	5	3

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern or was not rated. See text for descriptions of symbols and such terms as "rare" and "brief." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
Acuff:								
AcA, AcB, AcC----	B	None--------	---	---	>60	---	---	---
Amarillo:								
AfB----------	B	None--------	---	---	>60	---	---	---
[1]Am:								
Amarillo part---	B	None--------	---	---	>60	---	---	---
Urban land.								
Aspermont:								
[1]APD:								
Aspermont part--	B	None--------	---	---	>60	---	---	---
Enterprise part-	B	None--------	---	---	>60	---	---	---
[1]AQF:								
Aspermont part--	B	None--------	---	---	>60	---	---	---
Quinlan part----	C	None--------	---	---	10-20	Rippable	---	---
Bippus:								
BcA----------	B	Rare--------	Very brief	Apr-Oct	>60	---	---	---
BcB----------	B	None--------	---	---	>60	---	---	---
[1]Bd:								
Bippus part-----	B	Frequent	Very brief	Apr-Oct	>60	---	---	---
Spur part-------	B	Frequent	Very brief	Apr-Oct	>60	---	---	---
Burson:								
[1]BQG:								
Burson part-----	C	None--------	---	---	3-12	Rippable	---	---
Quinlan part----	C	None--------	---	---	10-20	Rippable	---	---
Rock outcrop.								
Clairemont:								
Cc----------	B	Occasional	Very brief	Apr-Nov	>60	---	---	---
[1]Cm:								
Clairemont part-	B	Occasional	Very brief	Apr-Nov	>60	---	---	---
Mangum part-----	D	Occasional	Very brief	Apr-Nov	>60	---	---	---
Ector:								
[1]ERE:								
Ector part-----	D	None--------	---	---	4-20	Hard	---	---
Rock outcrop.								
Estacado:								
EsA, EsB, EsC---	B	None--------	---	---	>60	---	---	---

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
[1]Eu: Estacado part--- Urban land.	B	None--------	---	---	>60	---	---	---
Knoco: [1]KBE: Knoco part------ Badland.	D	None--------	---	---	>60	---	---	---
Latom: [1]LAE: Latom part------ Rock outcrop.	D	None--------	---	---	8-20	Rippable	---	---
Likes: LeD----------	A	None--------	---	---	>60	---	---	---
Lincoln: [1]Lf----------	A	Common------	Very brief to brief.	Apr-Oct	>60	---	---	---
Lipan: Lh----------	D	Occasional	Long to very long.	Apr-Jun	>60	---	---	---
[1]Ln: Lipan part------ Urban land.	D	Occasional	Long to very long.	Apr-Jun	>60	---	---	---
Lofton: Lo----------	D	None--------	---	---	>60	---	---	---
Lofton: [1]Lu: Lofton part----- Urban land.	D	None--------	---	---	>60	---	---	---
Mangum: Ma----------	D	Occasional	Very brief	Apr-Nov	>60	---	---	---
Mobeetie: MfB, MfC, MfD----	B	None--------	---	---	>60	---	---	---
[1]Mo: Mobeetie part-- Urban land.	B	None--------	---	---	>60	---	---	---
[1]MTE: Mobeetie part--- Tascosa part----	B B	None-------- None--------	--- ---	--- ---	>60 >60	--- ---	--- ---	--- ---
[1]MVE: Mobeetie part--- Veal part-------	B B	None-------- None--------	--- ---	--- ---	>60 >60	--- ---	--- ---	--- ---
Olton: OcA, OcB---------	C	None--------	---	---	>60	---	---	---

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
[1]Ou:								
Olton part	C	None	---	---	>60	---	---	---
Urban land.								
Paloduro:								
PaB, PaC, PaD	B	None	---	---	>60	---	---	---
Posey:								
PcB, PcC, PcD	B	None	---	---	>60	---	---	---
[1]Pe:								
Posey part	B	None	---	---	>60	---	---	---
Urban land.								
Potter:								
[1]PMG:								
Potter part	C	None	---	---	>60	---	---	---
Mobeetie part	B	None	---	---	>60	---	---	---
Pullman:								
PuA, PuB	D	None	---	---	>60	---	---	---
[1]Px:								
Pullman part	D	None	---	---	>60	---	---	---
Urban land.								
Randall:								
Ra	D	Frequent	Long to very long.	May-Nov	>60	---	---	---
Tascosa:								
[1]TAF	B	None	---	---	>60	---	---	---
Tivoli:								
Tf	A	None	---	---	>60	---	---	---
[1]TSD:								
Tivoli part	A	None	---	---	>60	---	---	---
Springer part	B	None	---	---	>60	---	---	---
Veal:								
[1]VPD:								
Veal part	B	None	---	---	>60	---	---	---
Paloduro part	B	None	---	---	>60	---	---	---
Vernon:								
[1]VWF:								
Vernon part	D	None	---	---	>60	---	---	---
Owens part	D	None	---	---	10-20	Rippable	---	---
Weymouth:								
WeB, WeC	B	None	---	---	>60	---	---	---
[1]WVD:								
Weymouth part	B	None	---	---	>60	---	---	---
Vernon part	D	None	---	---	>60	---	---	---
Yomont:								
[1]Yo	B	Frequent	Very brief	Apr-Nov	>60	---	---	---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for composition and behavior of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

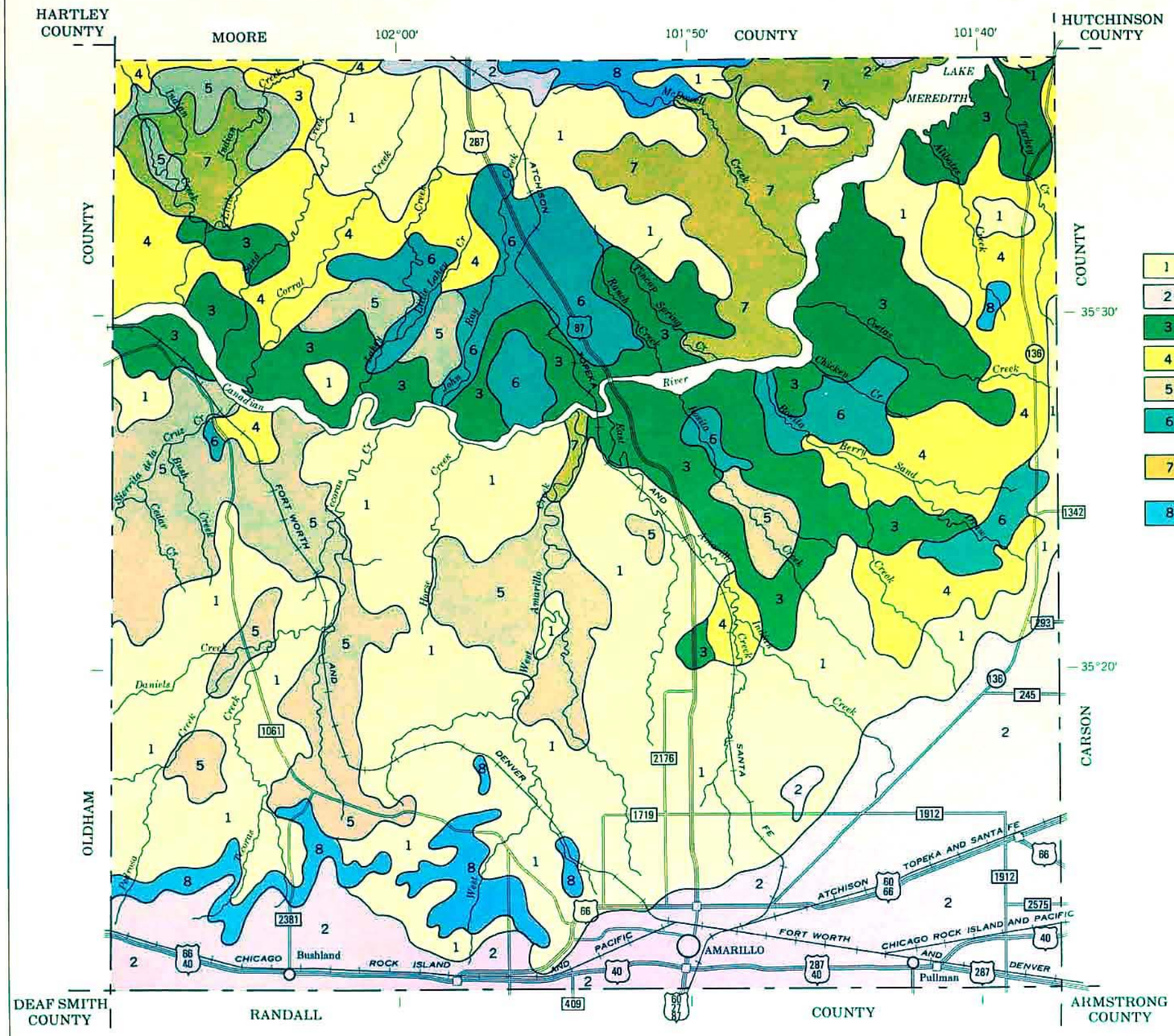
[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Acuff	Fine-loamy, mixed, thermic Aridic Paleustolls
Amarillo	Fine-loamy, mixed, thermic Aridic Paleustalfs
*Aspermont	Fine-silty, mixed, thermic Typic Ustochrepts
Bippus	Fine-loamy, mixed, thermic Cumulic Haplustolls
Burson	Loamy, mixed (calcareous), thermic, shallow Ustic Torriorthents
Clairemont	Fine-silty, mixed (calcareous), thermic Typic Ustifluvents
Ector	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Enterprise	Coarse-silty, mixed, thermic Typic Ustochrepts
Estacado	Fine-loamy, mixed, thermic Calciorthidic Paleustolls
Knoco	Clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents
Latom	Loamy, mixed (calcareous), thermic Lithic Ustic Torriorthents
Likes	Mixed, thermic Typic Ustipsamments
Lincoln	Sandy, mixed, thermic Typic Ustifluvents
Lipan	Fine, montmorillonitic, thermic Entic Pellusterts
Lofton	Fine, mixed, thermic Vertic Argiustolls
Mangum	Fine, mixed, thermic Vertic Ustochrepts
Mobeetie	Coarse-loamy, mixed, thermic Aridic Ustochrepts
Olton	Fine, mixed, thermic Aridic Paleustolls
Owens	Clayey, mixed, thermic, shallow Typic Ustochrepts
Paloduro	Fine-loamy, mixed, thermic Aridic Haplustolls
Posey	Fine-loamy, mixed, thermic Calciorthidic Paleustalfs
Potter	Loamy, carbonatic, thermic, shallow Ustollic Calciorthids
Pullman	Fine, mixed, thermic Torrertic Paleustolls
Quinlan	Loamy, mixed, thermic, shallow Typic Ustochrepts
Randall	Fine, montmorillonitic, thermic Udic Pellusterts
Springer	Coarse-loamy, mixed, thermic Udic Paleustalfs
Spur	Fine-loamy, mixed, thermic Fluventic Haplustolls
Tascosa	Loamy-skeletal, mixed, thermic Aridic Calciustolls
Tivoli	Mixed, thermic Typic Ustipsamments
Veal	Fine-loamy, carbonatic, thermic Aridic Ustochrepts
Vernon	Fine, mixed, thermic Typic Ustochrepts
Weymouth	Fine-loamy, mixed, thermic Typic Ustochrepts
*Yomont	Coarse-silty, mixed (calcareous), thermic Typic Ustifluvents

☆ U.S. GOVERNMENT PRINTING OFFICE 1980-299-998/61

NRCS Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.



LEGEND 1/

1	ACUFF-PALODURO-OLTON: Nearly level to sloping, deep, noncalcareous and calcareous loamy soils
2	PULLMAN: Nearly level to gently sloping, deep, noncalcareous loamy soils
3	MOBEETIE-TASCOSA: Gently sloping to hilly, deep, calcareous loamy soils
4	VEAL-MOBEETIE: Gently sloping to rolling, deep, calcareous loamy soils
5	WEYMOUTH-VERNON: Undulating to rolling, moderately deep, calcareous loamy and clayey soils
6	LIKES-TIVOLI: Gently undulating to rolling hummocks and dunes of deep, calcareous and noncalcareous sandy soils
7	BURSON-QUINLAN-ASPERMONT: Undulating to steep, very shallow, shallow, and deep calcareous loamy soils
8	POTTER-MOBEETIE: Sloping to steep, very shallow, shallow and deep calcareous gravelly and loamy soils

1/ The texture noted in the descriptive heading refers to the surface layer of the major soils.

Compiled 1979

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

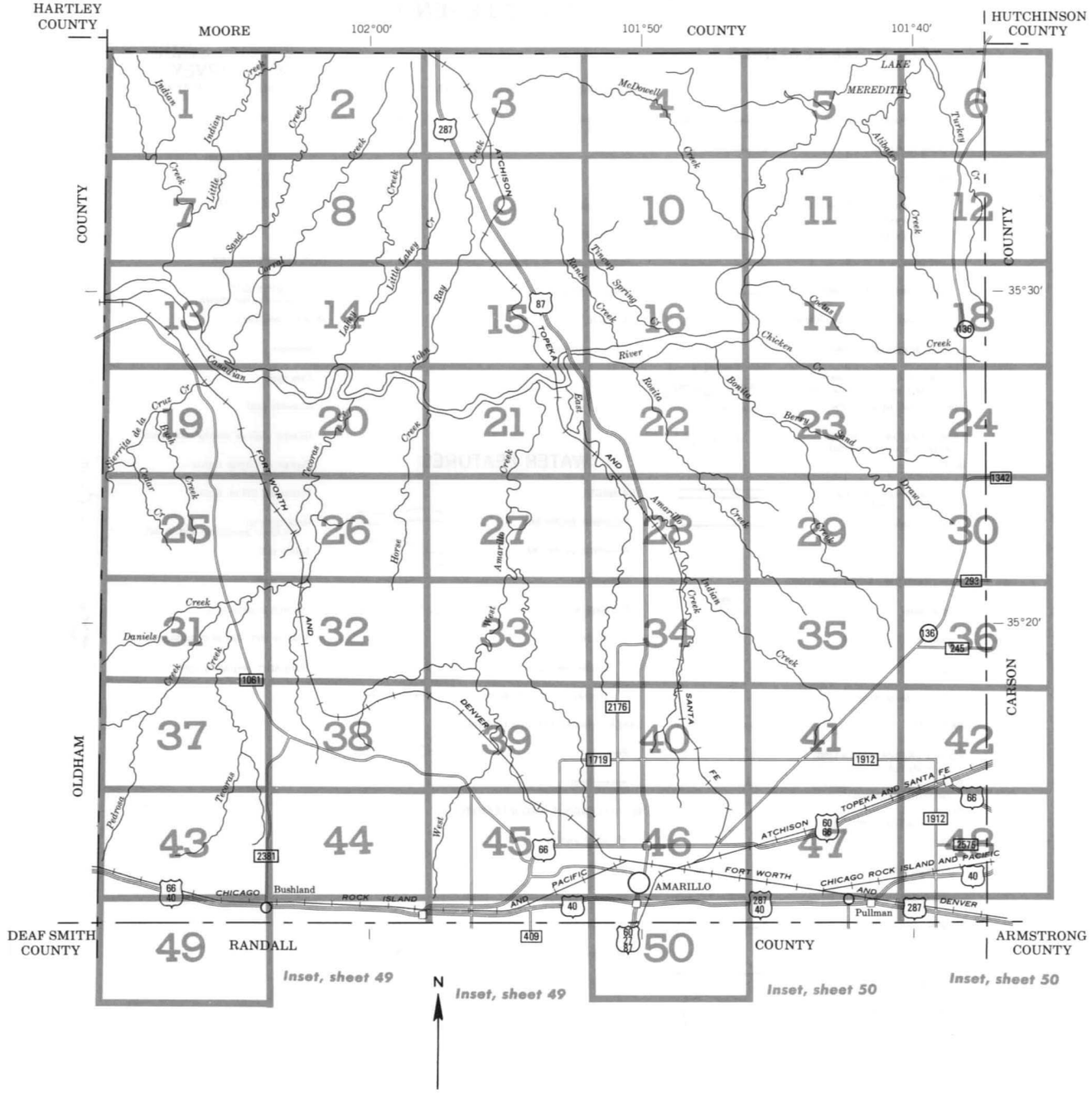
GENERAL SOIL MAP

POTTER COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km



INDEX TO MAP SHEETS

POTTER COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or conservation pool (Davis Airstrip, CONSERVATION POOL)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water)

PITS

- Gravel pit (GRAVEL PIT)
- Mine or quarry (Quarry)

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water, w)
- Intermittent (int, i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot
- Caliche pit (CALICHE PIT)

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA, FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a lower case letter for a narrowly defined unit and a capital letter for a broadly defined unit. Consecutive capital letters in the map symbols indicate the delineations are larger, and the composition of the unit is apt to be more variable than the other units in the survey area. The last capital letter, A, B, C, D, E, F, or G, shows the slope. Map symbols without a slope letter are for nearly level soils or soils without slope phases.

The symbol (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in some places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AcA	Acuff loam, 0 to 1 percent slopes
AcB	Acuff loam, 1 to 3 percent slopes
AcC	Acuff loam, 3 to 5 percent slopes
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes (W)
Am	Amarillo-Urban land complex
APD	Aspermont-Enterprise association, undulating
AQF	Aspermont-Quinlan association, hilly
BcA	Bippus clay loam, 0 to 1 percent slopes
BcB	Bippus clay loam, 1 to 3 percent slopes
Bd	Bippus and Spur soils, channeled
BQG	Burson-Quinlan-Rock outcrop association, steep
Cc	Clairemont silty clay loam, occasionally flooded
Cm	Clairemont and Mangum soils, channeled
ERE	Ector-Rock outcrop association, rolling
EsA	Estacado clay loam, 0 to 1 percent slopes
EsB	Estacado clay loam, 1 to 3 percent slopes
EsC	Estacado clay loam, 3 to 5 percent slopes
Eu	Estacado-Urban land complex
KBE	Knoco-Badland association, rolling
LAE	Latom-Rock outcrop association, rolling
LeD	Likes loamy fine sand, 1 to 8 percent slopes (W)
Lf	Lincoln soils, frequently flooded
Lh	Lipan clay
Ln	Lipan-Urban land complex
Lo	Lofton clay loam
Lu	Lofton-Urban land complex
Ma	Mangum clay, occasionally flooded
MfB	Mobeetie fine sandy loam, 1 to 3 percent slopes
MfC	Mobeetie fine sandy loam, 3 to 5 percent slopes
MfD	Mobeetie fine sandy loam, 5 to 12 percent slopes
Mo	Mobeetie-Urban land complex
MTE	Mobeetie-Tascosa association, rolling
MVE	Mobeetie-Veal association, rolling
OcA	Olton clay loam, 0 to 1 percent slopes
OcB	Olton clay loam, 1 to 3 percent slopes
Ou	Olton-Urban land complex
PaB	Paloduro clay loam, 1 to 3 percent slopes
PaC	Paloduro clay loam, 3 to 5 percent slopes
PaD	Paloduro clay loam, 5 to 8 percent slopes
PcB	Posey clay loam, 1 to 3 percent slopes
PcC	Posey clay loam, 3 to 5 percent slopes
PcD	Posey clay loam, 5 to 8 percent slopes
Pe	Posey-Urban land complex
PMG	Potter-Mobeetie association, steep
PuA	Pullman clay loam, 0 to 1 percent slopes
PuB	Pullman clay loam, 1 to 3 percent slopes
Px	Pullman-Urban land complex
Ra	Randall clay
TAF	Tascosa association, hilly
Tf	Tivoli fine sand (W)
TSD	Tivoli-Springer association, undulating (W)
UB	Urban land
VPD	Veal-Paloduro association, undulating
VWF	Vernon-Owens association, rolling
WeB	Weymouth clay loam, 1 to 3 percent slopes
WeC	Weymouth clay loam, 3 to 5 percent slopes
WVD	Weymouth-Vernon association, undulating
Yo	Yomont soils, frequently flooded

POTTER COUNTY, TEXAS NO. 1

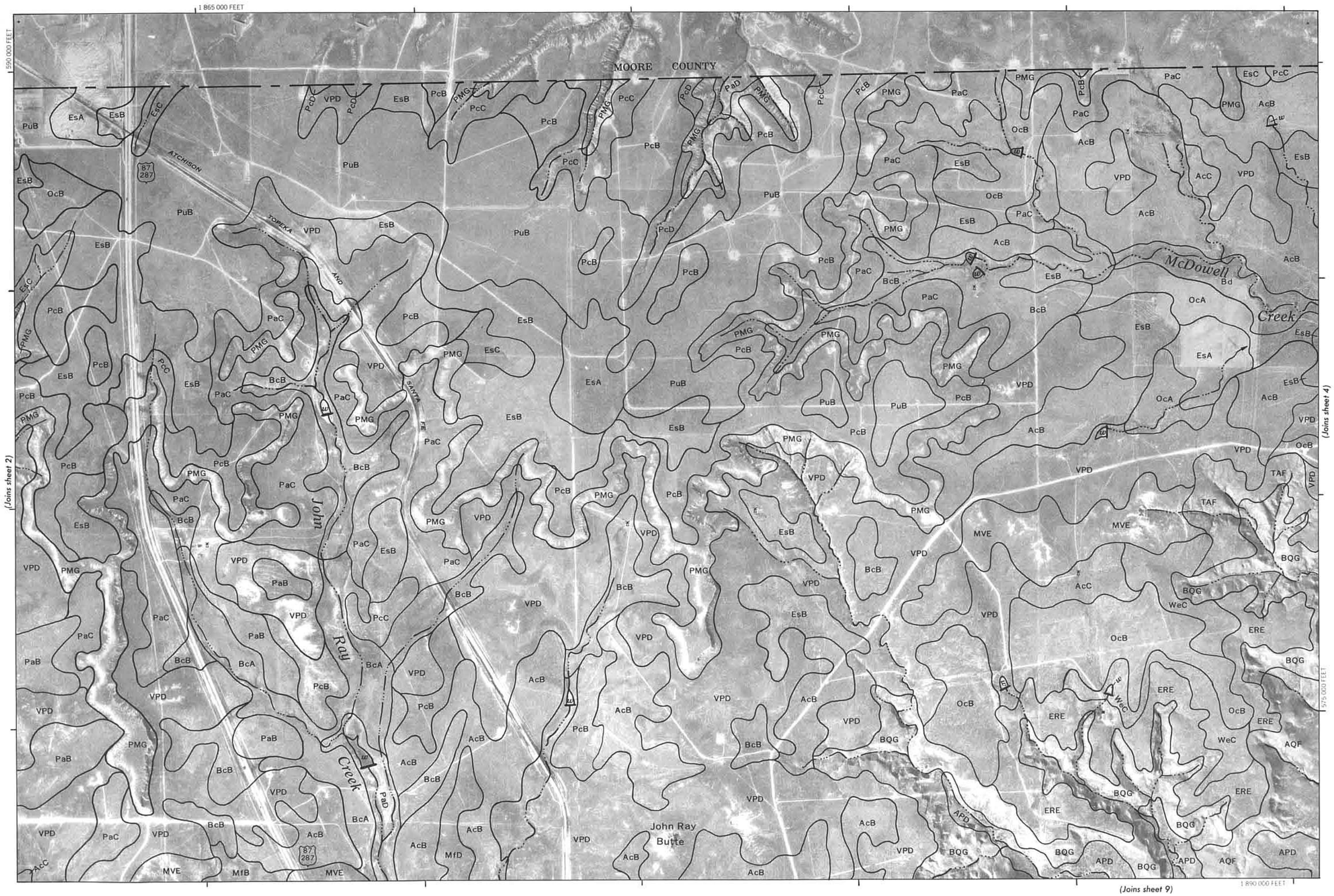
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 2

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 2

POTTER COUNTY, TEXAS — SHEET NUMBER 3



POTTER COUNTY, TEXAS NO. 3

This map is compiled on 1935 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

N

2 Miles

10000 Feet

Scale 1:24000

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 4

POTTER COUNTY, TEXAS — SHEET NUMBER 5

5

N

1 920 000 FEET

590 000 FEET

MOORE COUNTY

LAKE MEREDITH

SANFORD RECREATION AREA

CANADIAN RIVER

Rock Creek

Plum Creek

Alibates Creek

CONSERVATION POOL LINE

SANFORD

Cactus Flats

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 11)

1 945 000 FEET

575 000 FEET

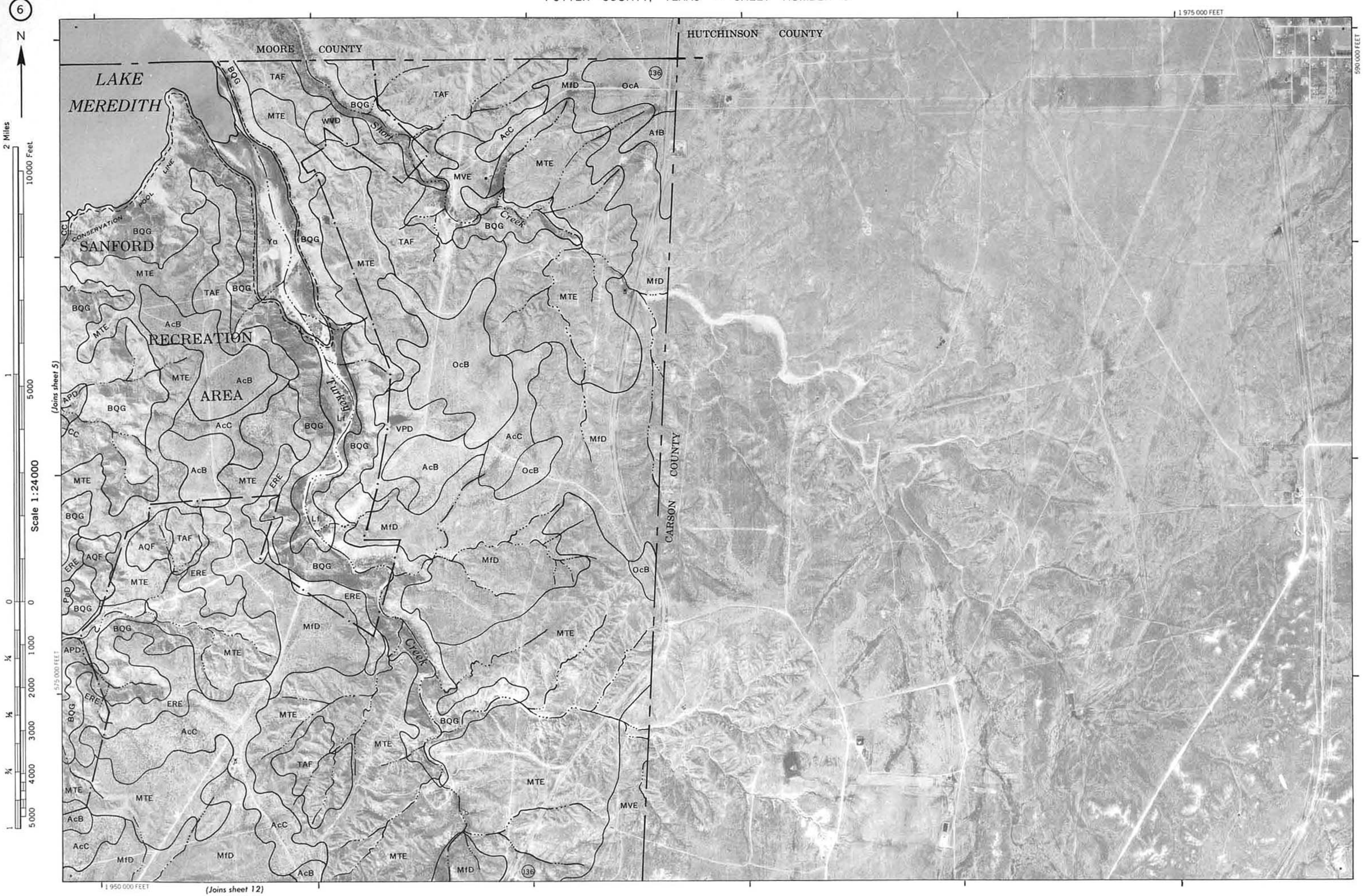
2 Miles

10000 Feet

Scale 1:24000

POTTER COUNTY, TEXAS NO. 5

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 6

POTTER COUNTY, TEXAS — SHEET NUMBER 7

POTTER COUNTY, TEXAS NO. 7

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 805 000 FEET

570 000 FEET

(Joins sheet 1)

(Joins sheet 8)

(Joins sheet 13)

1 830 000 FEET

555 000 FEET

OLDHAM COUNTY

INDEFINITE BOUNDARY

Indian Creek

Little Indian Creek

Indian Creek

Sand Creek

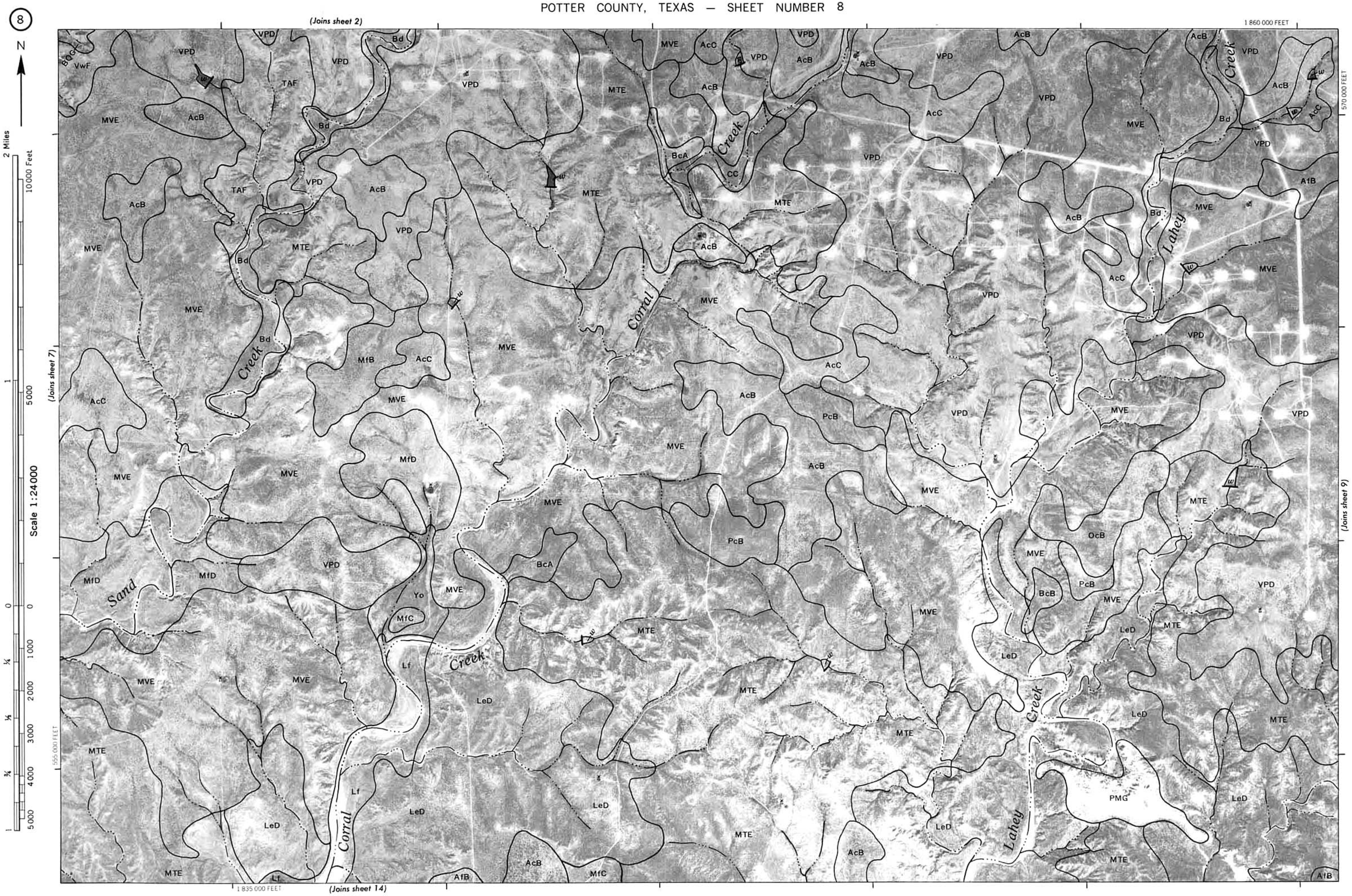
7

N

2 Miles

10000 Feet

Scale 1:24000



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 8

9

1 865 000 FEET

(Joins sheet 3)

570 000 FEET

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 15)

555 000 FEET

1 890 000 FEET

N

2 Miles

1

0

¼

½

¾

10000 Feet

5000

0

1000

2000

3000

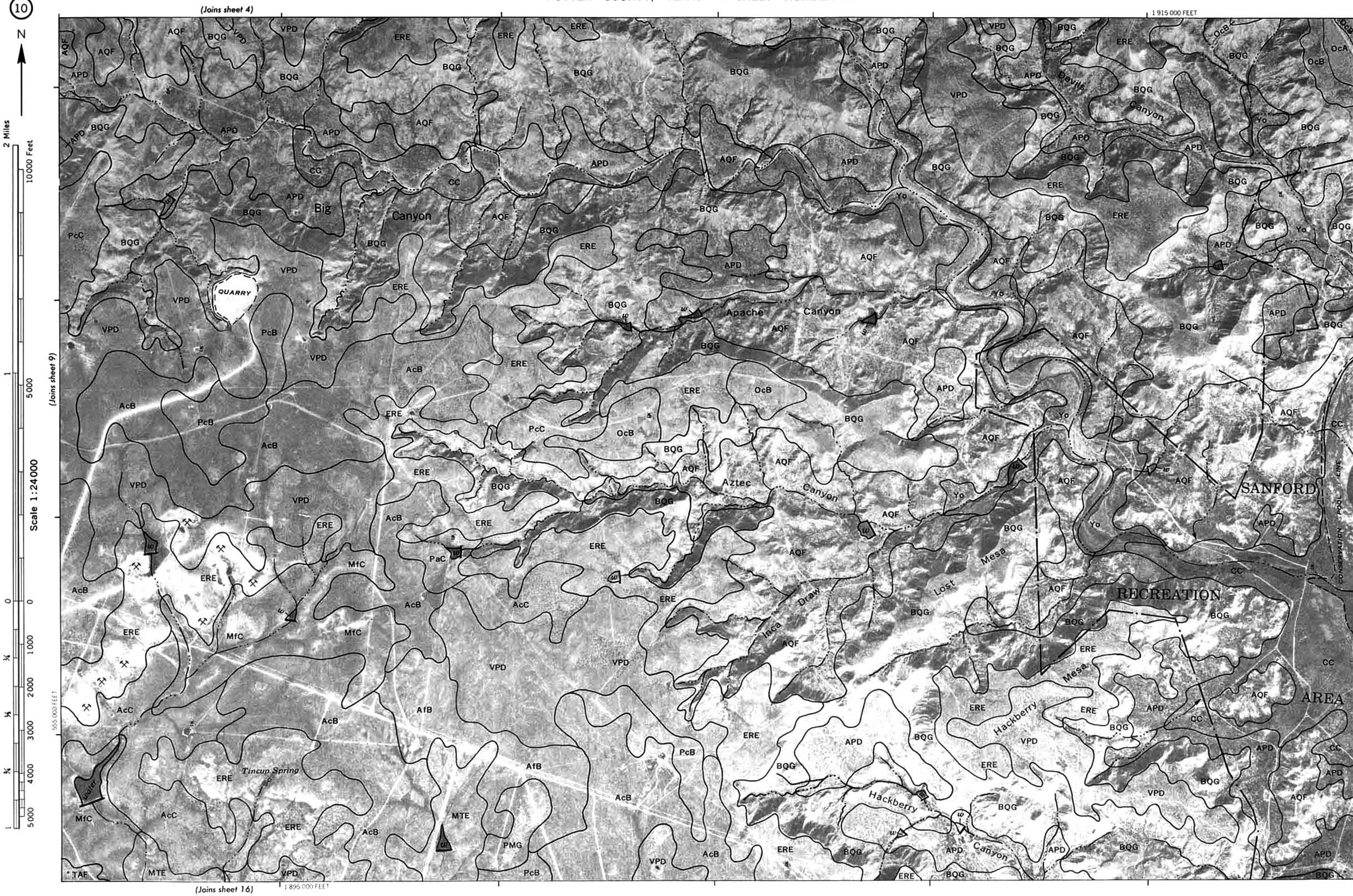
4000

5000

Scale 1:24 000

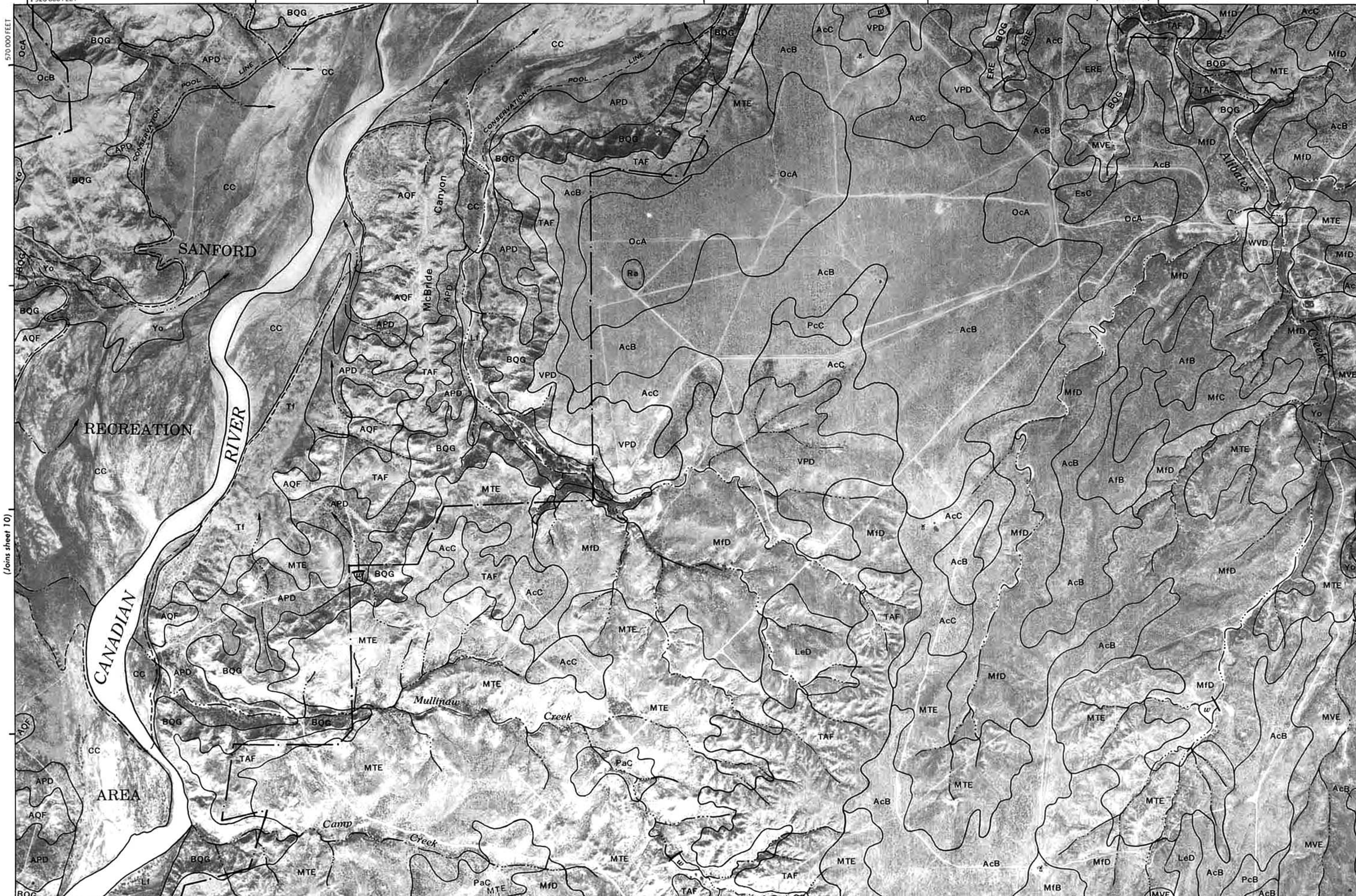
POTTER COUNTY, TEXAS NO. 9

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 10



Scale 1:24 000

2 Miles | 1 | ½ | 0

10000 Feet | 5000 | 0 | 1000 | 2000 | 3000 | 4000 | 5000

POTTER COUNTY, TEXAS NO. 11

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

12

N

(Joins sheet 6)

(Joins sheet 11)

(Joins sheet 18)

1 975 000 FEET

570 000 FEET

555 000 FEET

1 950 000 FEET

2 Miles

10000 Feet

Scale 1:24000

1 5000 4000 3000 2000 1000 0 0 1000 2000 3000 4000 5000

AcA AcB AcC LeD MfD MTE MVE OcA PMG TAF Tf VPD Yo

Turkey Creek

Alibates Creek

136

COUNTY

CARSON

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 12

POTTER COUNTY, TEXAS — SHEET NUMBER 13

13

1 805 000 FEET

(Joins sheet 7)

550 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 14)

1 830 000 FEET

(Joins sheet 19)

535 000 FEET

CANADIAN RIVER

Indian Creek

Sand Creek

Corral Creek

CANADIAN RIVER

OLDHAM COUNTY

INDEFINITE BOUNDARY

GRAVEL PIT

FORT WORTH

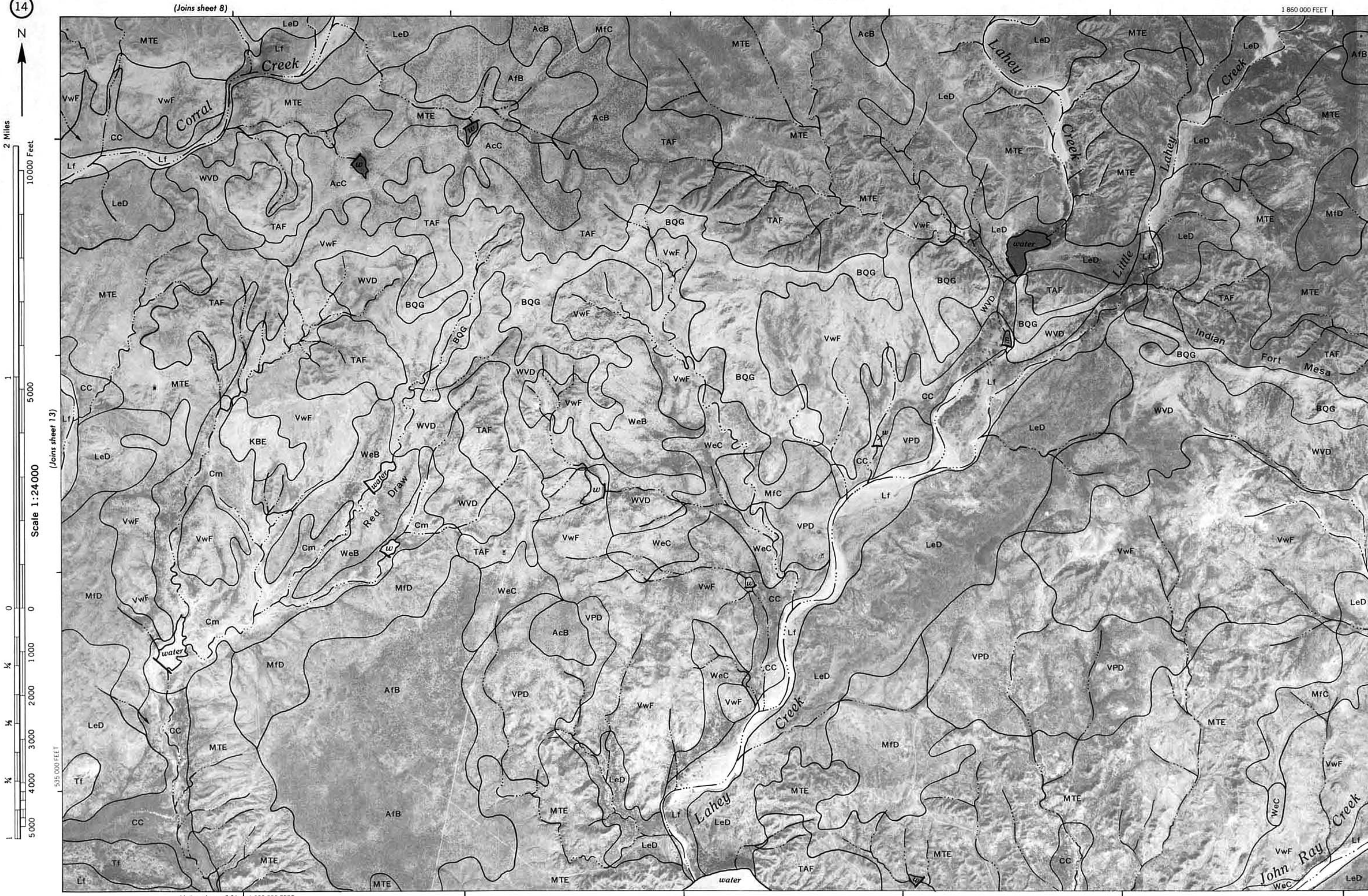
DENVER

Ady

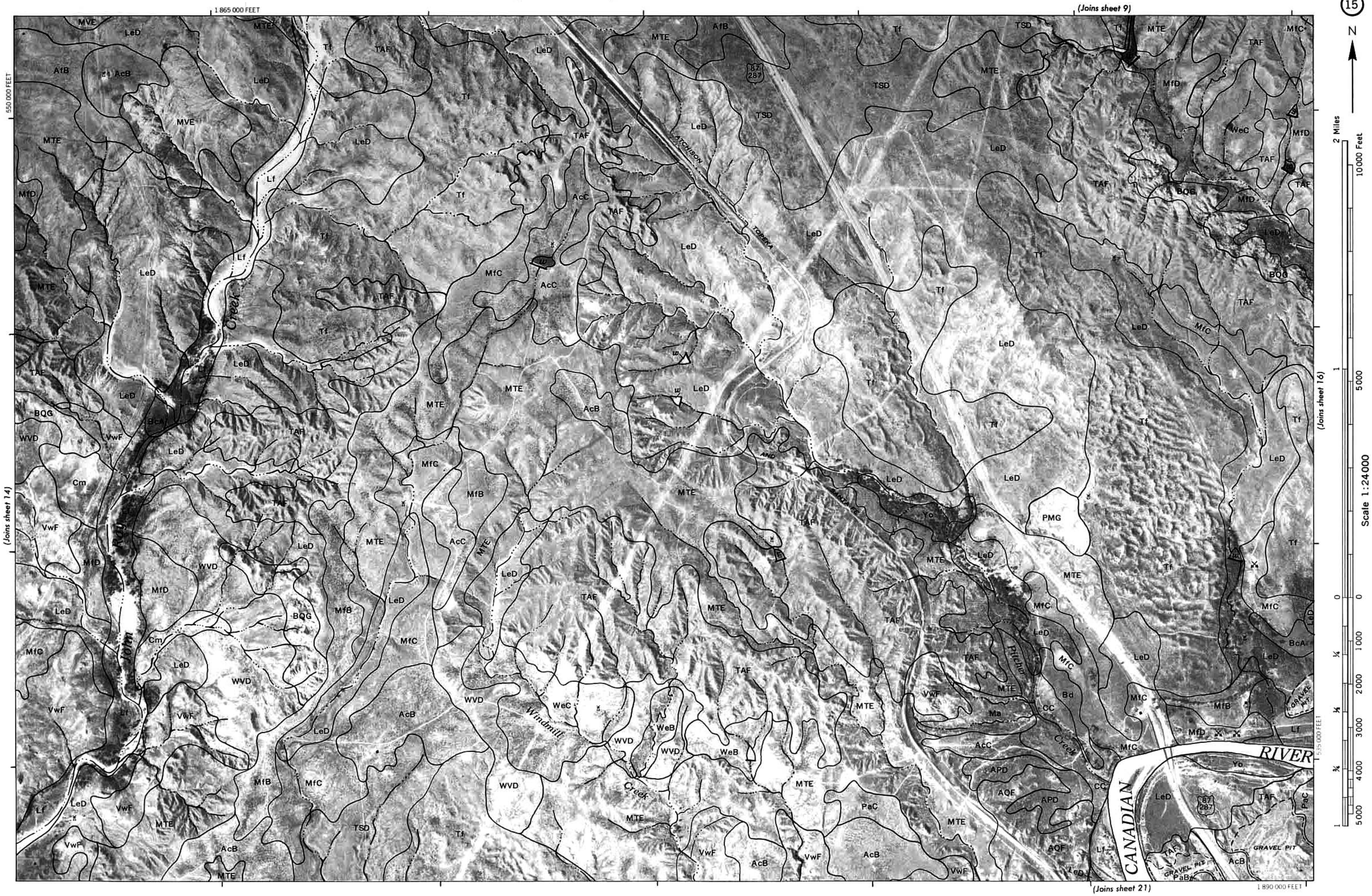
106

POTTER COUNTY, TEXAS NO. 13

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



POTTER COUNTY, TEXAS NO. 15

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

16

N

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0 5000

(Joins sheet 10)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 22)

1 915 000 FEET

535 000 FEET

1 890 000 FEET

CANADIAN RIVER

SANFORD RECREATION AREA

Hackberry Canyon

Saddle Horse Canyon

Papoose Draw

Tincup Draw

Frio Draw

Spring Draw

Ranch Creek

Water Creek

Bonita Creek

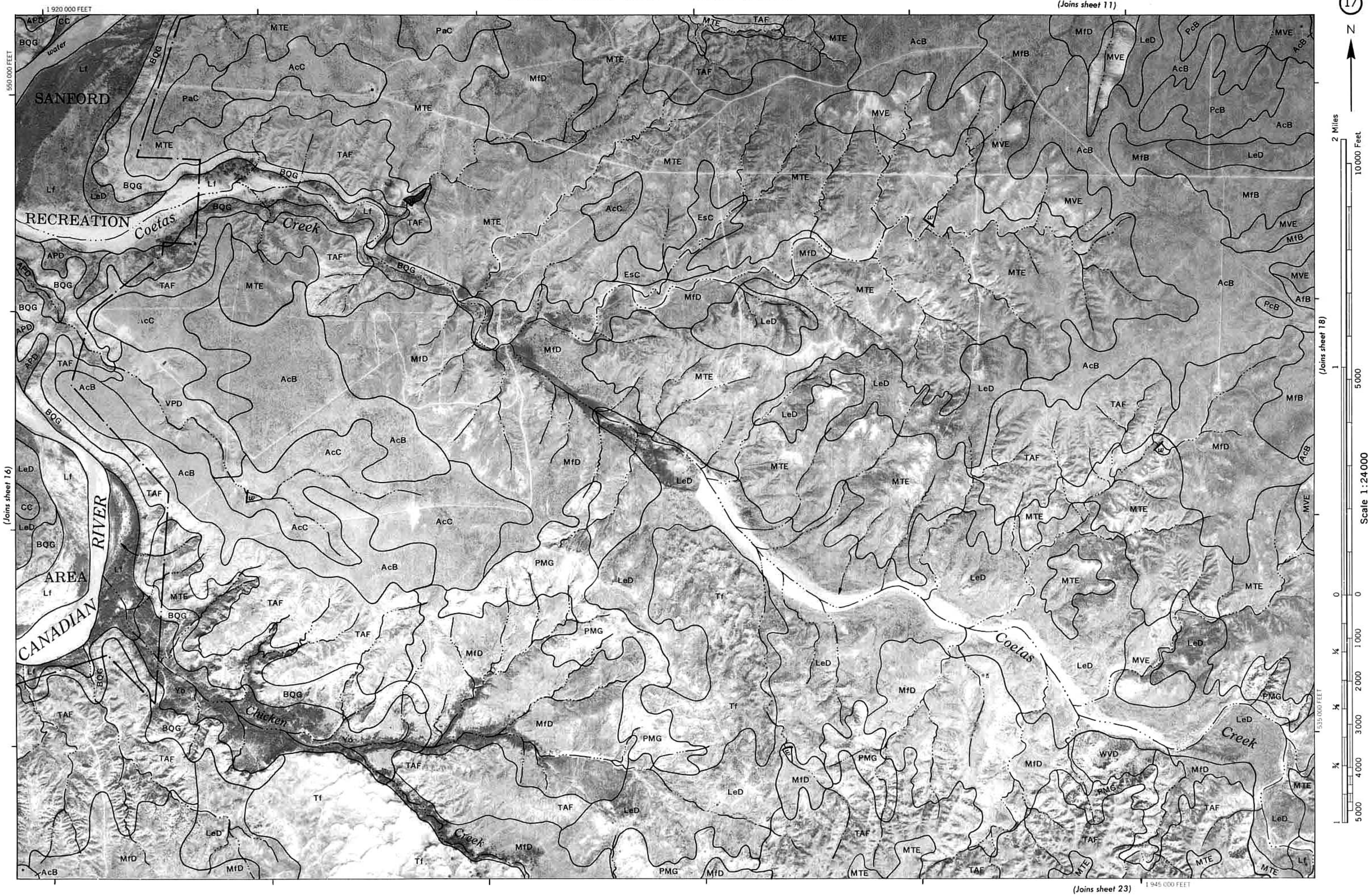
CALICHE PIT

GRAVEL PIT

AcB AcC BcA CC ERE LeD Lf MfB MfC MfD MTE PaB PaC PaD PcB PMG PuB Tf TAF VPD WVD Yo BQG APD

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

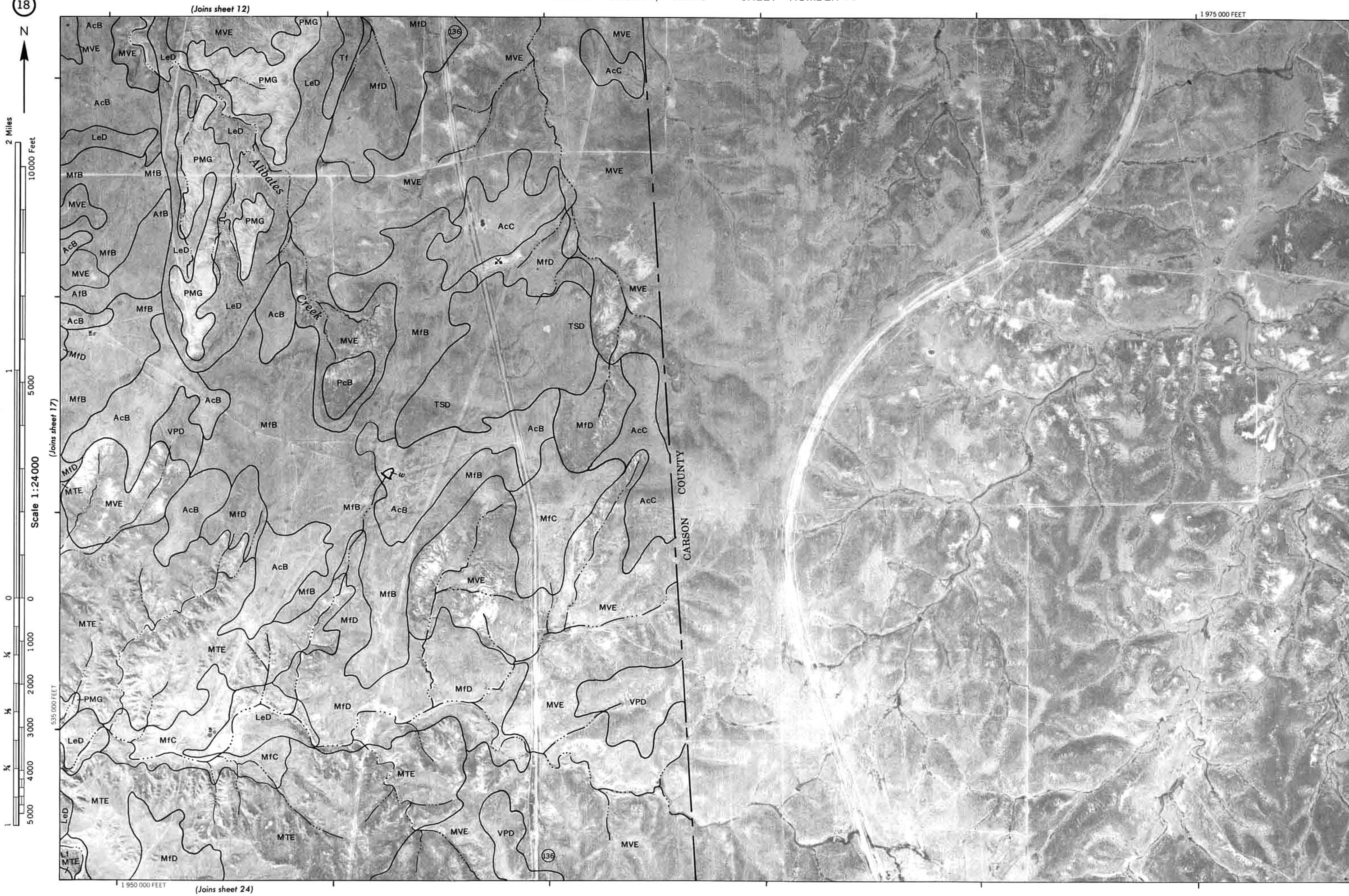
POTTER COUNTY, TEXAS NO. 16



POTTER COUNTY, TEXAS NO. 17

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 18

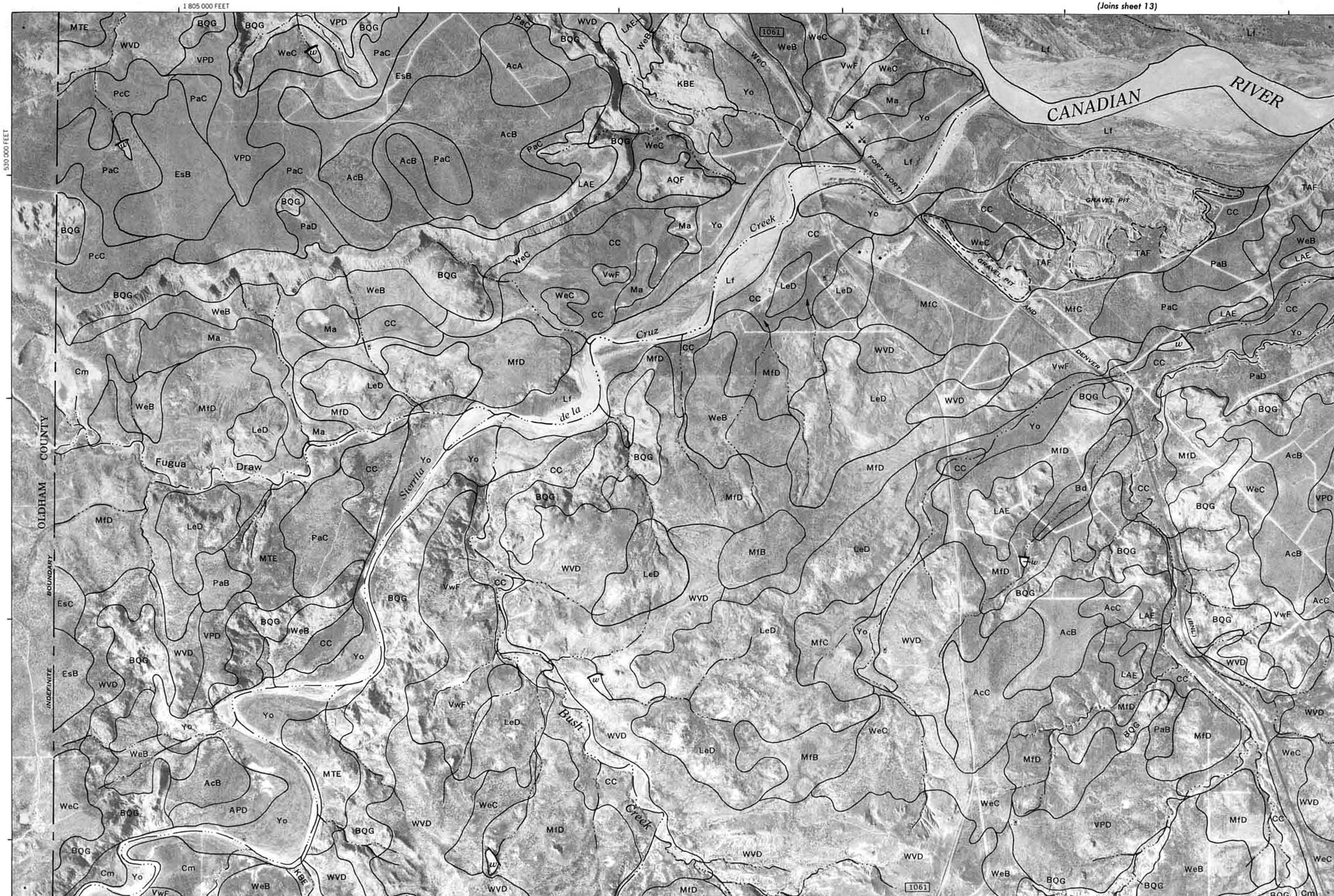


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 18

POTTER COUNTY, TEXAS — SHEET NUMBER 19

19



POTTER COUNTY, TEXAS NO. 19

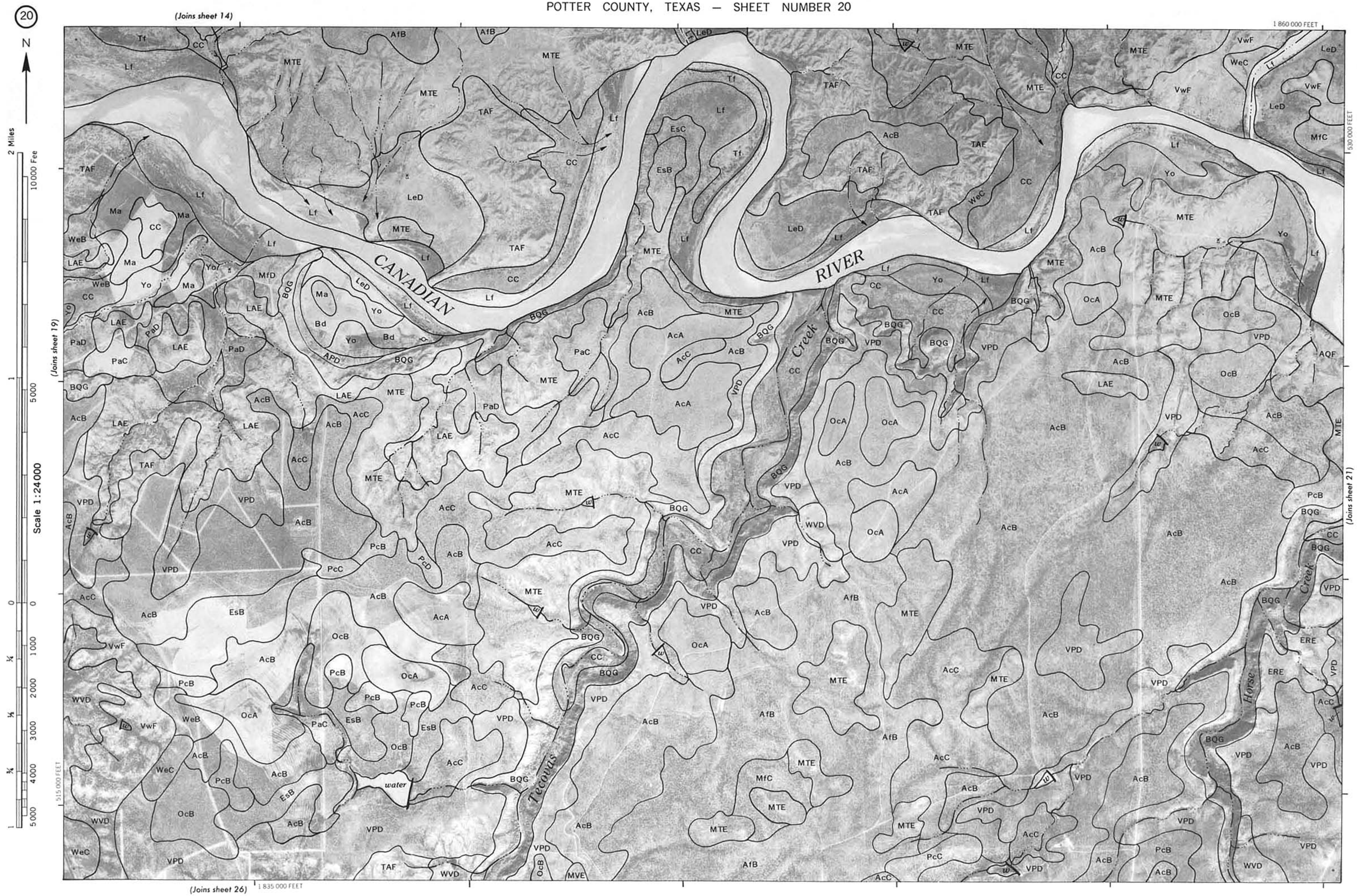
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

Scale 1:24 000

2 Miles, 1, 0, 1

10000 Feet, 5000, 0, 5000



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

21

(Joins sheet 15)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 27)

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5000 0

5000 4000 3000 2000 1000 0 5000

1 ¾ ½ ¼ 0

POTTER COUNTY, TEXAS NO. 21

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 23

1 920 000 FEET

530 000 FEET

(Joins sheet 17)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 29)

1 945 000 FEET

515 000 FEET

Chicken Creek

Bonita Creek

Berry Sand Draw

Bonita Creek

TAF AcB MfD LeD Tf PMG MfC BQG Lf BcA Yo Bd MVE PaD PaC PaB MTE CC WeC VPD MfB AcG Qu

N

Scale 1:24000

2 Miles 1

10000 Feet 5000

0 1 000 2 000 3 000 4 000 5 000

24

N

2 Miles

10000 Feet

1

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

(Joins sheet 18)

1 975 000 FEET

530 000 FEET

515 000 FEET

1 950 000 FEET

(Joins sheet 23)

(Joins sheet 30)

Coetas Creek

CARSON COUNTY

MTE, MfD, Lf, LeD, MfB, MfD, AcB, MVE, VPD, 136, AcC, EsB, PcB, PMG, BcA, MfC, TSD, 1342

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 24

POTTER COUNTY, TEXAS NO. 25
This map is compiled on 1915 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

1 805 000 FEET

(Joins sheet 19)

510 000 FEET

OLDHAM COUNTY

INDEFINITE BOUNDARY

Bush Creek

Cedar Creek

Sierrita de la Cruz Creek

1061

(Joins sheet 26)

(Joins sheet 31)

1 830 000 FEET

495 000 FEET

25

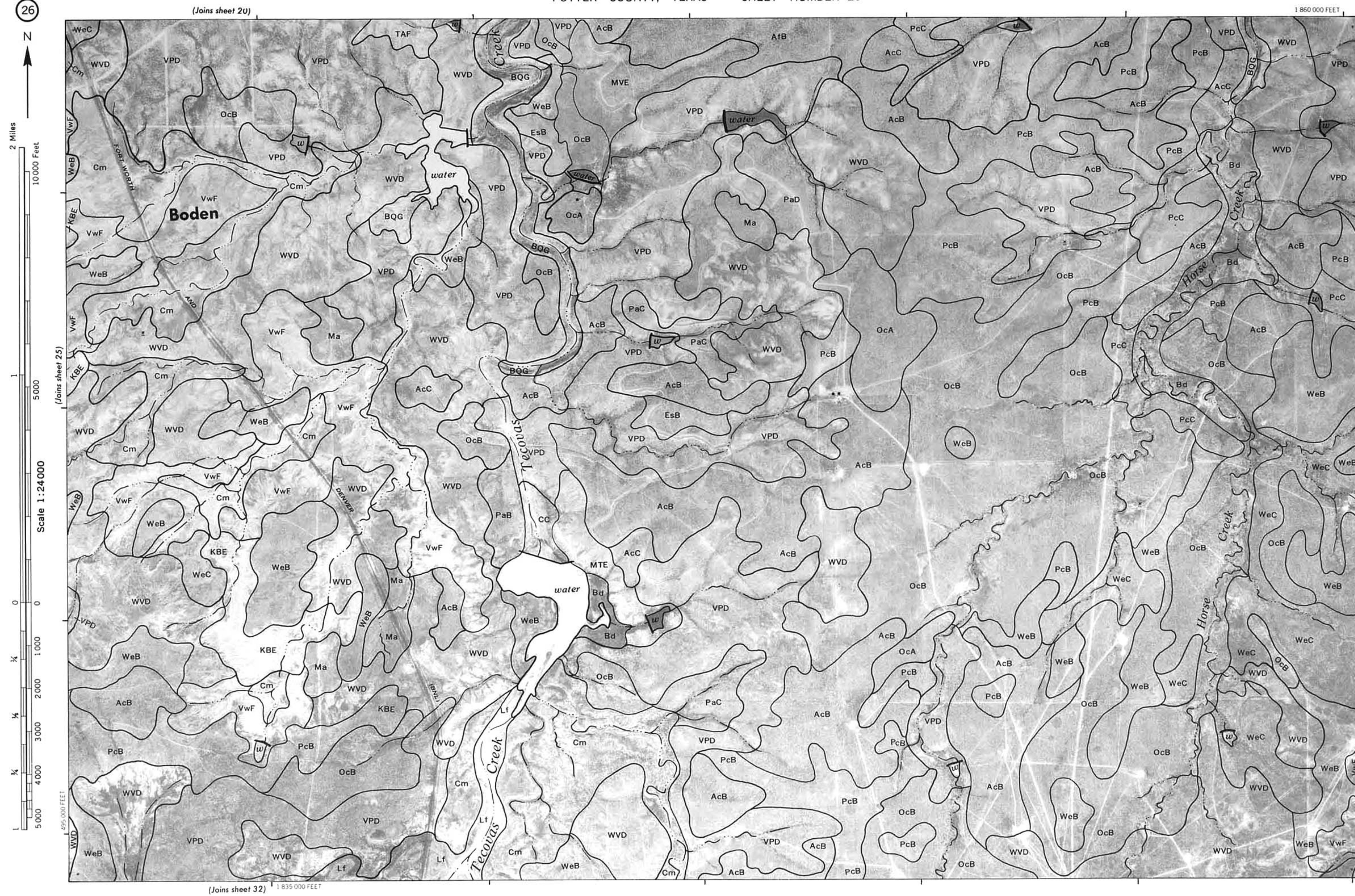
N

2 Miles

10000 Feet

Scale 1:24000

POTTER COUNTY, TEXAS — SHEET NUMBER 26



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 26

POTTER COUNTY, TEXAS — SHEET NUMBER 27

POTTER COUNTY, TEXAS NO. 27

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 860 000 FEET

510 000 FEET

(Joins sheet 21)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 33)

1 885 000 FEET

435 000 FEET

27

N

2 Miles

10000 Feet

1

5000

Scale 1:24000

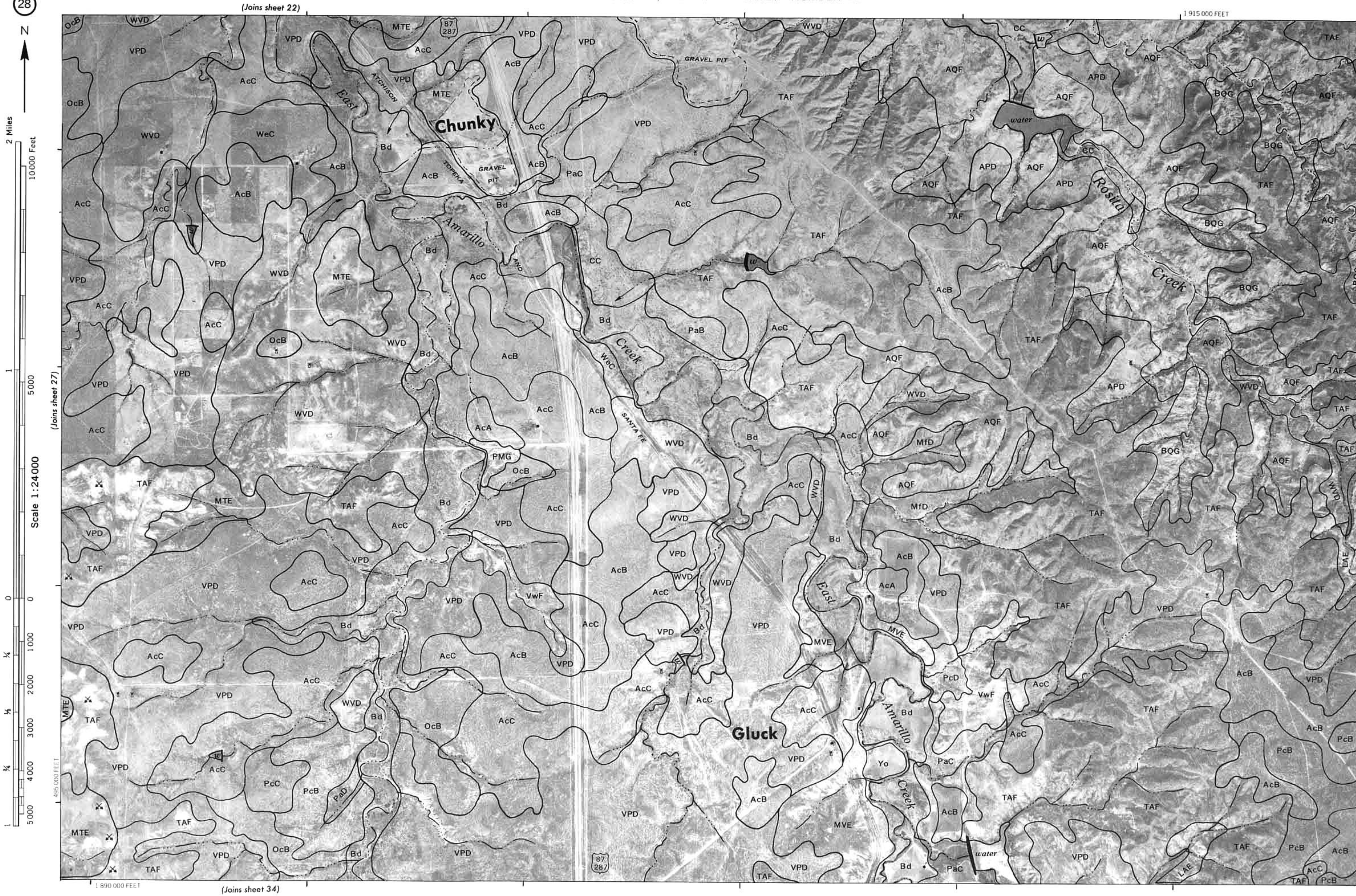
0 1000 2000 3000 4000 5000

Amarillo

PMG

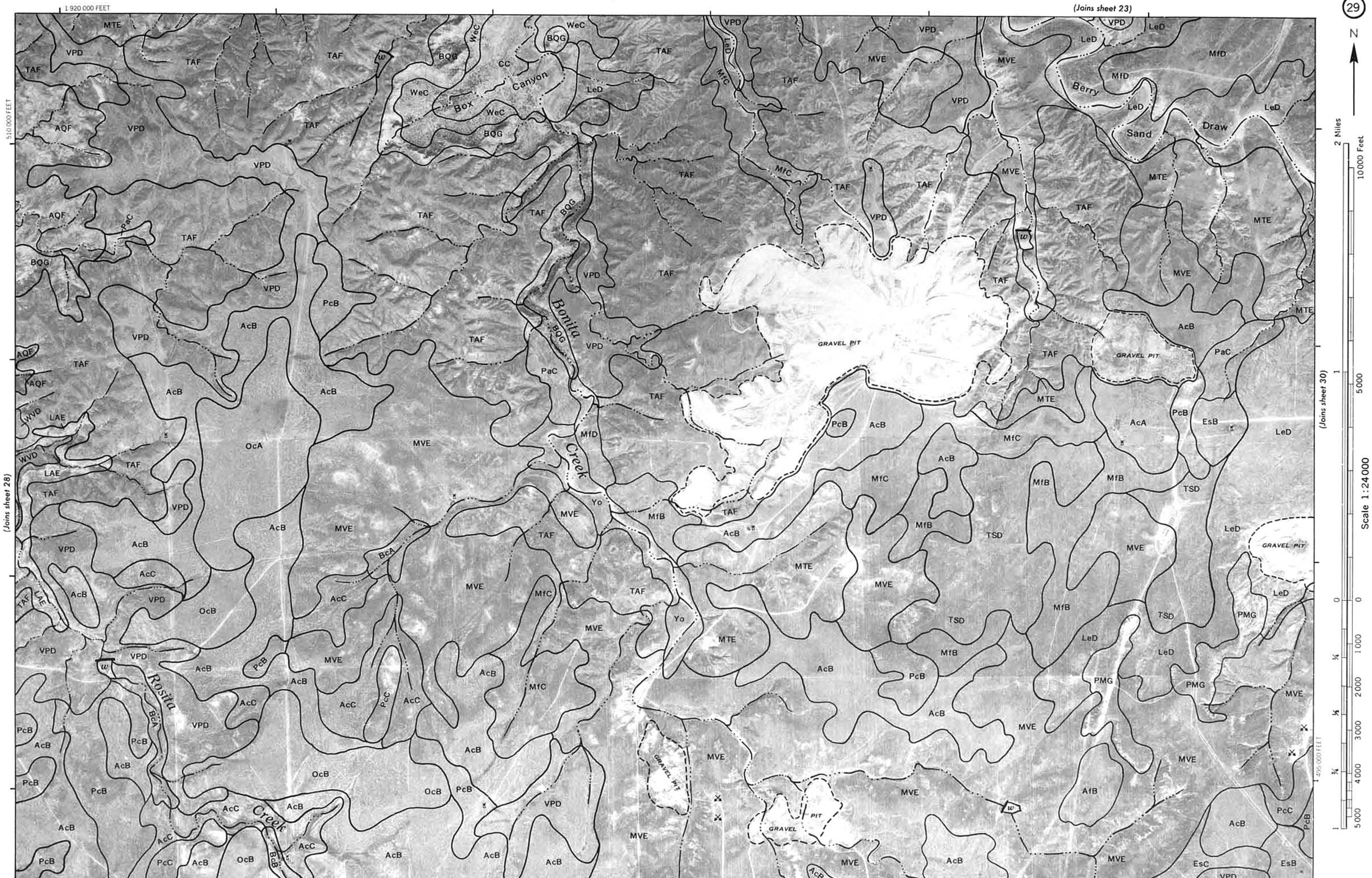
Creek

West



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 29



POTTER COUNTY, TEXAS NO. 29

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 30

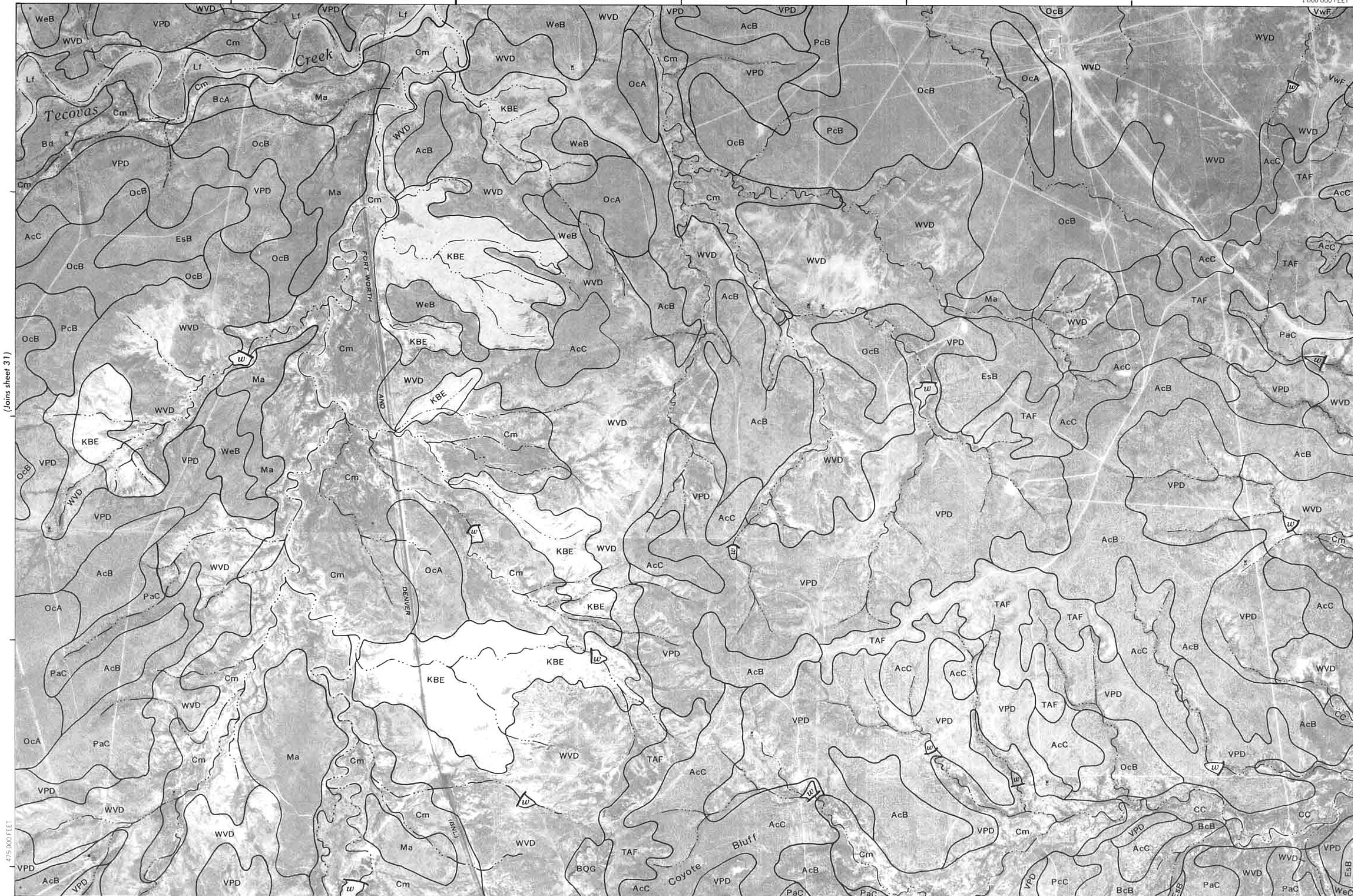
POTTER COUNTY, TEXAS — SHEET NUMBER 31

POTTER COUNTY, TEXAS NO. 31

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 32

32



N

2 Miles
10000 Feet
1
5000
0
0
1000
2000
3000
4000
5000
1
Scale 1:24000

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 32

POTTER COUNTY, TEXAS NO. 33

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 34

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 35

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 920 000 FEET

490 000 FEET

(Joins sheet 29)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 41)

1 945 000 FEET

475 000 FEET

35

N

Scale 1:24000

2 Miles

10000 Feet

5000

Rosita Creek

Bonita Creek

Indian Creek

Stalanaker Lake

water

6 5 4

67 66 45 44

136

AcB AcC BcB EsB EsC LAE MfB MVE OcB PaC PcB PcC PcD PMG PuA PuB Ra TAF Ub VPD w

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 36

POTTER COUNTY, TEXAS NO. 37

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 38

38

N

(Joins sheet 32)

1 850 000 FEET

470 000 FEET

(Joins sheet 37)

(Joins sheet 39)

455 000 FEET

1 830 000 FEET

(Joins sheet 44)

2 Miles

10000 Feet

Scale 1:24000

Gentry

FORT WORTH AND DENVER

GRAVEL PIT

Goat Mountain

Wolf Mountain

1061

2381

POTTER COUNTY, TEXAS NO. 38

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 39

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 860 000 FEET

(Joins sheet 33)

470 000 FEET

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 45)

1 885 000 FEET

455 000 FEET

39

N

2 Miles

10000 Feet

Scale 1:24000

Tascosa Hills

Rolling Hills

Cliffside

Bishop Hills

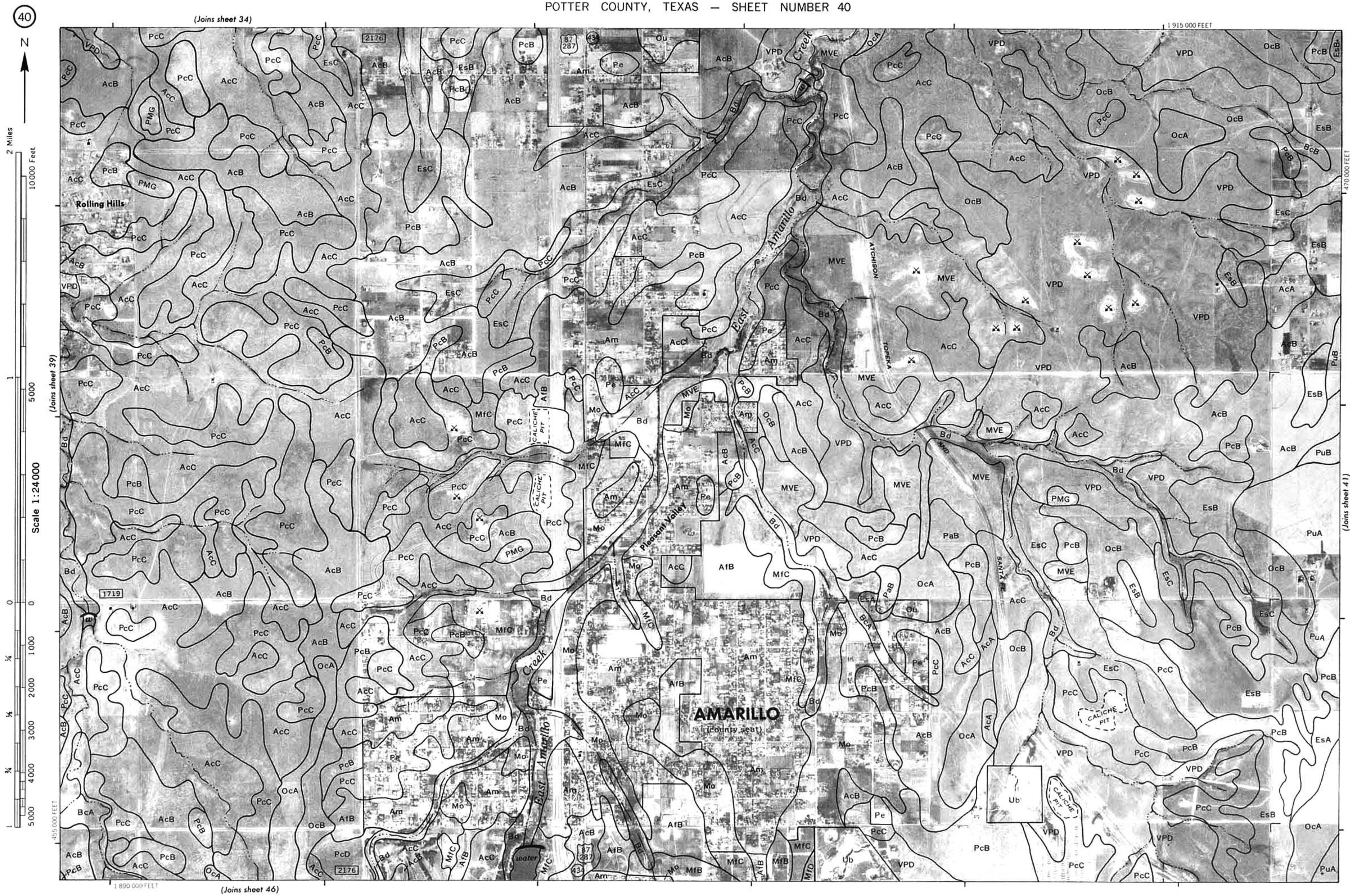
West Amarillo Creek

FORT WORTH AND DENVER (BNL)

CALICHE PIT

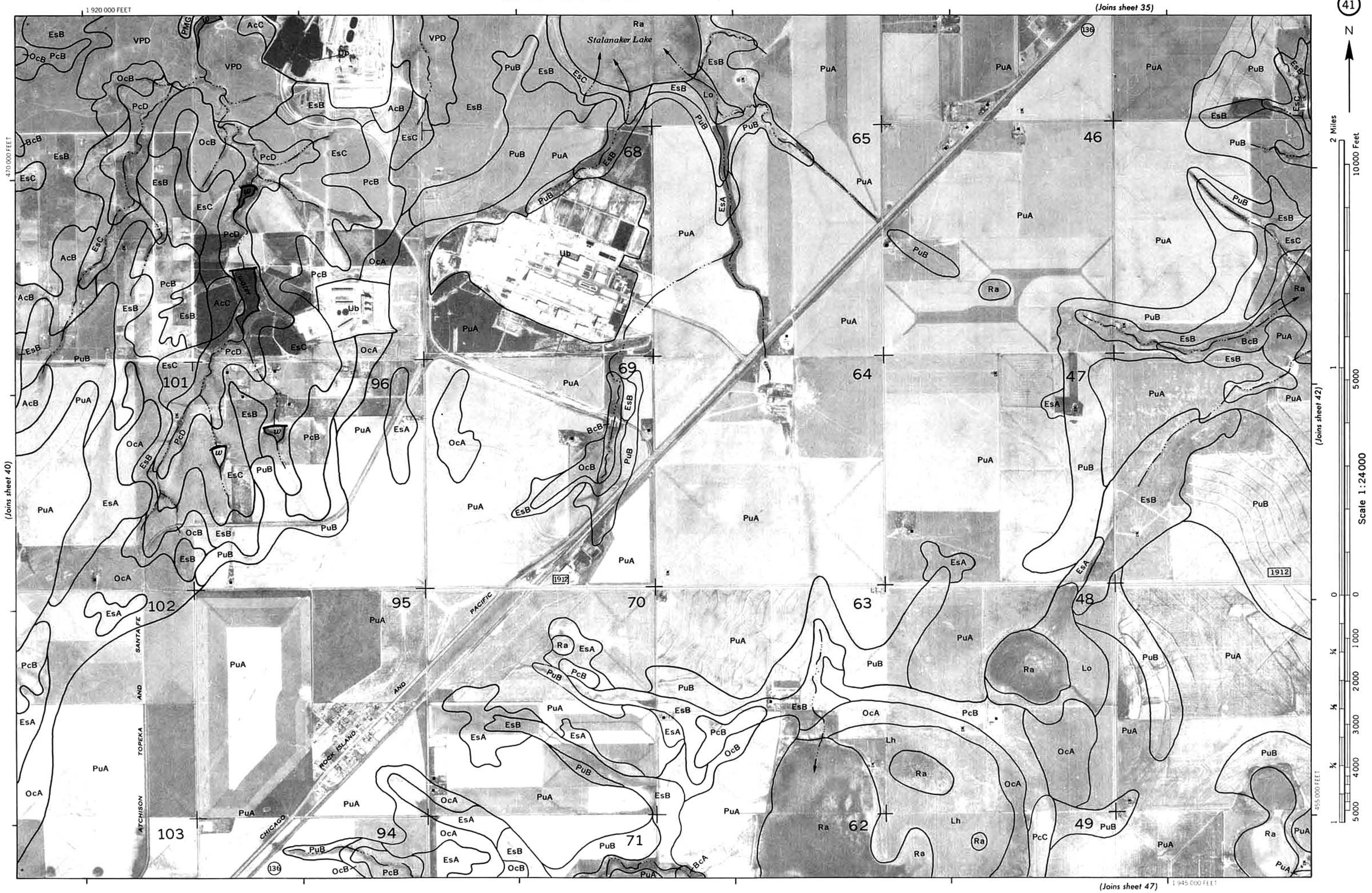
1719

1061



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 40



POTTER COUNTY, TEXAS NO. 41
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

42

N

2 Miles

10000 Feet

1 5000

Scale 1:24000

0 0 1000 2000 3000 4000 5000

¼ ¼ ¼ ¾ ¾

(Joins sheet 36)

(Joins sheet 41)

(Joins sheet 48)

1 975 000 FEET

470 000 FEET

455 000 FEET

1 950 000 FEET

McGee Lake

SANTA FE AND TOPEKA ATCHISON

CARSON COUNTY

PuA PuB EsB EsC EsA PcB PcD Ra Lo

43 24 21 2 42 25 20 3 41 26 19 4 27 18 5

1912 60 66

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 42

POTTER COUNTY, TEXAS NO. 43

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(45)

N

2 Miles
10000 Feet
Scale 1:24 000

POTTER COUNTY, TEXAS NO. 45

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 46

(Joins sheet 40)

N

(Joins sheet 45)

(Joins sheet 47)

(Joins sheet 50)

Scale 1:24000

2 Miles | 1 | 0

10000 Feet | 5000 | 0

5000 | 4000 | 3000 | 2000 | 1000 | 0

1 Kilometer | ¾ | ½ | ¼ | 0

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 47

POTTER COUNTY, TEXAS NO. 47

This map is compiled on 1935 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 920 000 FEET

450 000 FEET

(Joins sheet 41)

(Joins sheet 46)

(Joins sheet 48)

(Joins inset A, sheet 50)

1 945 000 FEET

435 000 FEET

47

N

2 Miles

10000 Feet

Scale 1:24000

Folsum

AMARILLO
(county seat)

Municipal Airport

Amarillo

Pullman

(BNL)

93

72

52

SANTA FE AND TOPEKA ATCHISON

CHICAGO ROCK ISLAND AND PACIFIC

FORT WORTH AND DENVER

CHICAGO ROCK ISLAND AND PACIFIC

PuA PuB EsA EsB EsC OcA OcB PcB PcC Ra BcA Lh Lo Px Eu Ub w water

(Joins sheet 42)

(Joins sheet 47)

(Joins inset B, sheet 50)

N

Scale 1:24 000

2 Miles

10000 Feet

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS — SHEET NUMBER 49

POTTER COUNTY, TEXAS NO. 49

This map is compiled on 1970 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 805 000 FEET

435 000 FEET

OLDHAM COUNTY

DEAF SMITH COUNTY

3000 AND 5000-FOOT GRID TICKS

RANDALL COUNTY

(Joins sheet 43)

CHICAGO ROCK ISLAND AND PACIFIC

Ida Lake

34 33 32 4 197

(Joins inset A, lower left)

432 000 FEET

INSET A

1 830 000 FEET

2381

Bushland

CHICAGO ROCK ISLAND AND PACIFIC

178 163 144 129 110 95

(Joins sheet 44)

(Joins inset A, upper right)

(Joins inset B, lower left)

3000 AND 5000-FOOT GRID TICKS

1 855 000 FEET

INSET B

1 860 000 FEET

76 61 42

CHICAGO ROCK ISLAND AND PACIFIC

AMARILLO
(county seat)

water

(Joins sheet 45)

(Joins inset A, upper right)

(Joins sheet 50)

4000 AND 5000-FOOT GRID TICKS

1 885 000 FEET

431 000 FEET

RANDALL COUNTY

49

N

2 Miles

10000 Feet

5000

Scale 1:24000

50

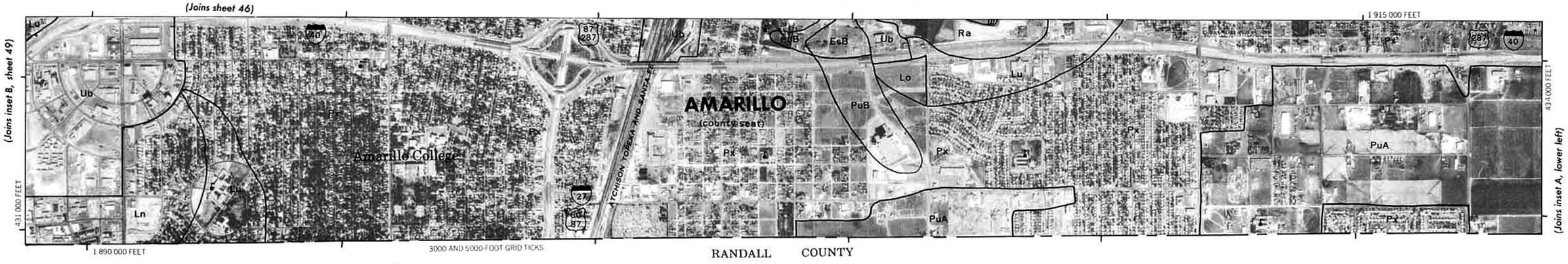
POTTER COUNTY, TEXAS — SHEET NUMBER 50

N

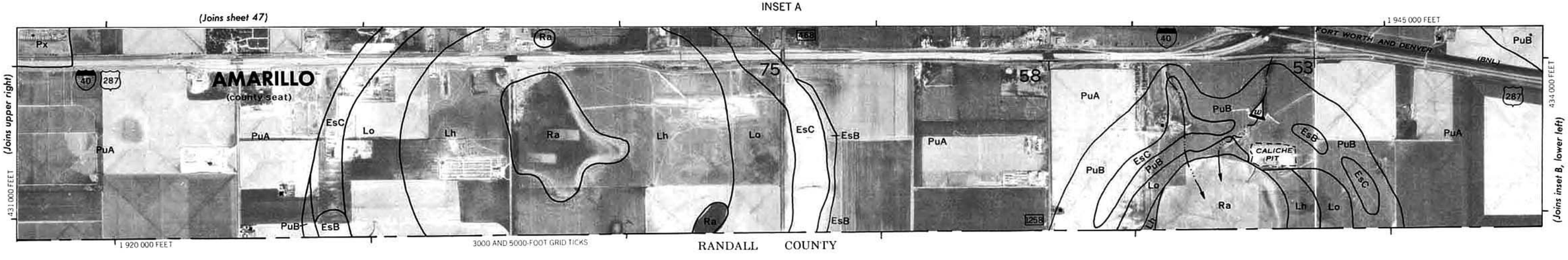
2 Miles 10000 Feet

Scale 1:24000

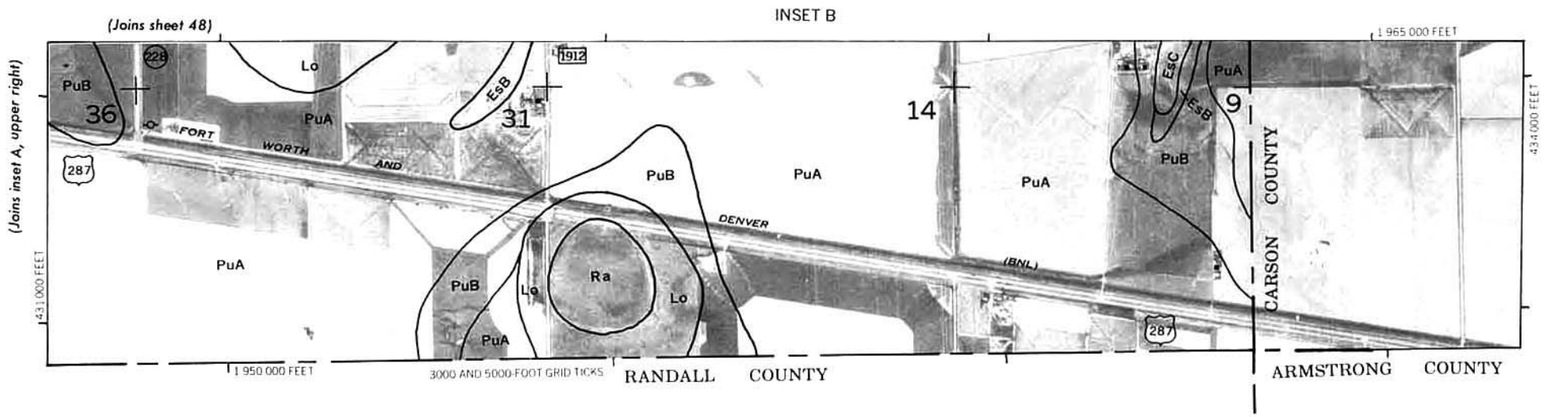
1 5000 0 1000 2000 3000 4000 5000



INSET A



INSET B



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTER COUNTY, TEXAS NO. 50